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71
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29 JULY 1987

SCIENCE & TECHNOLOGY

USSR: COMPUTERS

CONTENTS

APPLICATIONS

NETWORKS

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INEFFICIENT USE OF COMPUTER CENTERS IN TADKHIKISTAN SCORED

Moscow EKONOMICHESKAYA GAZETA in Russian No 43, Oct 86 pp 12-13

[Article by I. Soliyev, candidate of economic sciences, Dushanbe: "Computers Await Assignments"; first paragraph in boldface in source]

[Text] There are now 39 computer centers in Tadkhikistan. A total of 21 organizations now have computers. How are they used? Frankly speaking, still unsatisfactorily.

The normative planned load for most computers is 15 hours in 24 hours. In fact, however, with rare exception, it is almost one-half of this. The average daily load of computers based on general-purpose processors in the republic last year was 10.6 hours and of mini- and microcomputers, 8 hours.

It is especially low at the following: the Gosagroprom, 3.3 hours; the Leninabad Silk Combine of the Ministry of Light Industry, 2 hours; the Tadkhik Scientific Research Institute of Scientific and Technical Information of the Gosplan, 7.6 hours. The situation with respect to the use of mini- and microcomputers is even worse. For example, on the average, they operate 1.8 hours at the Administration of Geology, 3 hours at the Ministry of Trade, 3.6 hours at the Gosagroprom, and 4.5 hours at the republic's Gosplan.

One of the main reasons for the low efficiency of computer hardware lies in the following: Modern computers make it possible to operate in two information processing modes -- task-by-task and multiprogramming, that is, processing several assignments simultaneously. In other words, if there are five problems, each of which requires 2 hours of computer time, their task-by-task solution gives a load of 10 hours, while their simultaneous solution, about 2 1/2 hours.

Naturally, under these conditions most computer centers are objectively interested in the first mode: Both reporting is good and income is bigger. Of course, such an approach is not official, but by no means every manager will be able to resist the temptation of the profitable method. However, what is to be done with those who, all the same, use the multiprogramming mode? Effectiveness is present in this case. However, there is no single method of accounting and settling accounts with consumers and of drawing up the plan for computer operations and statistical reporting. Moreover, not all computer

centers can handle such a mode. After all, it requires high skills on the part of service personnel and modern software.

Different operating systems, systems programs, and applications program packages used as basic software during problem formulation at times make the dialog of two republic computer centers similar to the conversation of people not knowing each other's language. The republic algorithm and program fund created in Tadkhikistan turned out to be a "firm on paper." It had neither an integrity of actions, nor of resources. The fate of the Interdepartmental Commission on Automated Control Systems, whose sections, including for software, according to the idea, were supposed to serve as a coordinating and in some sense legislative body in the republic, is even more mysterious. It turns out that the new sector in the republic does not have a real manager.

There are also other problems brought about by the lack of departmental coordination. Almost every republic ministry and department establishes republic and support computer centers in oblast centers for the introduction of sectorial automated control systems. As a result, computers are not used efficiently enough. For example, the Gosagroprom and the republic Ministry of Motor Transport established sectorial oblast computer centers in Leninabad, Kulyab, and Kurgan-Tyube. Was there a need for this if computer centers of statistical administrations, whose load was not full either, existed in these cities?

What is the reason for such a lack of correspondence? First of all, it should be noted that the coordination of computer center activity and of computer use in various national economic sectors is not carried out satisfactorily in the republic. There are frequent cases when at first computers are purchased and then personnel are selected, software is prepared, and problems are sought. According to the results of activity last year, 17 cost accounting computer centers had a profit and 5, losses. The results of financial activity of four computer centers were not at all planned or determined.

Centralized technical computer servicing in the region needs to be improved fundamentally. The Dushanbe Affiliate of the SoyuzEVMkompleks Firm is not sufficiently staffed with specialists capable of promptly and qualitatively performing it with respect to the entire list of computer devices. Any technical malfunctions result in a long downtime, which lowers the computer readiness factor significantly.

Consolidation of computer centers and their centralized use have become objective necessities. Scientific production associations, which provide the best conditions for synthesizing science with production, represent the most efficient organizational form of developing these types of computer centers. It is advisable to determine prices and rates of services depending on the necessary expenditures on the collection, processing, storage, and transmission of information with a differention according to the categories of the computers being used and the nature of executed operations.

There is an urgent need to develop on the basis of the existing price list the entire set of unified rates and prices of information computer services of a computer center irrespective of its departmental subordination and status.

Many problems connected with organizing the operation of computer centers and introducing automated control systems have accumulated. Planning and economic bodies, sectorial computer centers, academic institutes, and higher educational institutions have the final say here.

11439
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LACK OF COORDINATION IN COMPUTER DEVELOPMENT CRITICIZED

Moscow PRAVDA in Russian 20 Oct 86 p 7

[Article by academician A. Tikhonov, director of the Institute of Applied Mathematics imeni M. V. Keldysh of the USSR Academy of Sciences, dean of the Faculty of Computer Mathematics and Cybernetics of Moscow State University, Hero of Socialist Labor: "We Develop From Practice"]

[Text] I would like to precede my thoughts with certain personal recollections. I hope that from the subsequent exposition it will become clear why they are needed here.

My scientific activity began in the middle of the 1920's at Moscow State University under the guidance of the prominent Soviet mathematician P. S. Aleksandrov. At that time I studied topology--one of the abstract sections of mathematics--and obtained results which gained world recognition. Recently, getting acquainted with me, some scientists have asked: "Are you the same Tikhonov who developed one of the sections of topology?" It is difficult for them to believe this, because my scientific work has long been connected basically with applied research.

Soon after defending my diploma thesis I began to study geophysics, in particular problems of gravitational, electromagnetic, and seismological measurements. During the Great Patriotic War I took part in an expedition, which searched for petroleum in the region of "second Baku."

From the position of a "pure" mathematician I should have considered the tasks facing the expedition insoluble, because abundant geological prospecting data are always distorted by errors. After all, it is impossible to reconstruct an accurate appearance of an object from its few eroded traces. Geological prospecting data are also "traces." As was considered in classical mathematics at that time, it is impossible to reconstruct the outline of a petroleum bearing structure according to them.

Such problems are considered incorrect--not having a single steady solution. A distinctive mathematical veto was imposed on them as long ago as the beginning of the century. Meanwhile, my colleagues in the expedition--petroleum industry workers--found petroleum, and quite efficiently at that. Not going into mathematical fine points, they used the method of selecting

theoretical curves most corresponding to experimental data. At the same time, they intuitively used additional information on the configuration of typical petroleum bearing structures accumulated owing to practical experience.

Participation in geophysical research gave me the first impetus to work on the solution of incorrect problems opening up a new scientific direction. Computers did not exist yet at that time. When they were developed, I proposed methods of automatic selection realized on computers.

The applications of these methods are very broad. Modern applied research constantly poses incorrect tasks. Automation of the processing of scientific research results, optimal planning in the economy, optimal planning of complex structures, medical diagnosis, the study of handicaps, and image recognition--everything that is united by the term "mathematical diagnosis"--lead to them.

Close contacts and, in fact, permanent joint work by practical specialists and mathematicians are the basic features of the research conducted here. A mathematician can write an equation describing the object of research. However, this is only one of the parts in the formulation of a problem. To obtain the desired results, additional information, which practical workers possess owing to their experience, is often needed.

An extensive application of computers is another feature of this work. At present the intensification of scientific research lies not in the solution of individual, even if important, equations. It is necessary to develop technology for the computer solution of broad categories of problems concerning scientific and technical progress. Therefore, informatics--science forming the basis for such technology--acquires primary importance.

What ensures close and fruitful cooperation between practical workers and informatics specialists? The role of the director of a scientific collective uniting both is very important here. We rightfully connect the spectacular advances in applied nuclear physics and in the conquest of outer space attained by our country with the names of such outstanding organizers of science as I. V. Kurchatov, M. V. Keldysh, and S. P. Korolev. The lack of just as strong and effective scientific guidance is one of the reasons for our lag in a number of directions in scientific and technical progress.

Unfortunately, this is what has happened with the development and production of domestic computers. There is no unified coordinated scientific guidance here and, in my opinion, one of the main reasons for this difficult situation created in this most important area lies in its absence. Different types of computers, which do not interface, have been produced. Provision has not been made for their efficient technical servicing. At times plans for the production of computer hardware merely determine momentarily conducted, not long-term, studies.

A lack of coordination also reigns in our computer software. There is no real information on what was and is being done and where. This does not lead merely to duplication, but to a frequent and contradictory repetition of the same developments. It is clear why such big hopes are pinned on the Department of Informatics, Computer Technology, and Automation of the USSR

Academy of Sciences and, primarily, on the recently established USSR State Committee for Computer Technology and Informatics.

With regard to the introduction of computer hardware the following situation is often observed here: For example, a new production shop or a technological section, which is also equipped with computers intended to automate and streamline new production, is built. However, there are no programs for production automation, according to which the "electronic brain" will operate. It is assumed that they will be developed later. When they are written finally, it becomes clear that existing computers do not perform them in the best way. It is necessary to "squeeze in" the written programs into computers not adapted for them, lossing time and resources and lowering production efficiency as a whole.

Probably, when developing complicated production complexes, it is necessary to equally and simultaneously be concerned both about software for production automation and about the selection of computers capable of realizing these programs. This again requires close cooperation between practical workers and informatics specialists and competent management of the entire collective uniting both.

Of course, sometimes, owing to the vast scope of forthcoming work, it is difficult for one man to cover the entire range of problems subject to solution, including purely organizational ones. In such cases it seems advisable to me to establish councils of scientific directors. Such a council should include no more than three to five people, because, otherwise, it will be difficult to work out a common decision.

In our opinion, it is necessary to more sharply delimit scientific and administrative guidance. When all problems--concerning the scientific, organizational, and economic plan--are piled up on the director, the efficiency of scientific guidance is undermined significantly. In large scientific research institutes, in addition to a scientific director, it is advisable to have an administrative director entrusted with the organizational part of work. It can be stated that such a position exists in many scientific research institutes. The trouble is that many deputies for administrative work are not at the level of the problems facing them. Probably, the time has come to raise the question of purposefully training people in this specialization.

The duty of the director of a scientific research institute is not only to develop the field of science, which he considers his and which has led him to the post of director. He should keep abreast of the share of participation of "his" science in scientific and technical progress and to lively respond to its needs. I am convinced that only a close joint activity of science and production workers is capable of producing major advances in the presently unfolding scientific and technical revolution. I believe that practice in the solution of problems concerning scientific and technical progress creates new fundamental directions in science.

As we see, the problems now facing science and production are complex. In order to solve them successfully, the specialist should receive good training.

In my opinion, an efficiently operating "science-education-industry" chain should ensure a success of this endeavor.

A successful way of realizing such a chain has been found at the Institute of Applied Mathematics imeni M. V. Keldysh of the USSR Academy of Sciences, which, on the one hand, jointly with large industrial enterprises actively participates in the solution of key national economic problems and, on the other, serves as the basic organization for our leading higher educational institutions, such as the Moscow Physical and Technical Institute, Moscow State University (Faculty of Computer Mathematics and Cybernetics), and others. Many associates at the Institute of Applied Mathematics, combining more than one job, teach at these higher educational institutions and guide students working on diploma projects and graduate students. Students at these higher educational institutions, beginning from the third course, take part in the institute's activity. Those who make marked advances, upon graduation from a higher educational institution or completion of graduate studies, are put on our staff. They immediate join work and become acclimated in the collective.

Things being as they are, the specialist is trained, so to speak, "by the piece," not "serially." In my opinion, specialists for scientific institutions should be turned out precisely by this method. Of course, this method presupposes an extensive job combination system. People who today direct scientific and technical progress should teach students, who are its future creators. This is impossible to do from books and manuals, which, as a rule, reflect yesterday's level.

This is how, in my concept, the concluding stage of the training of the future scientific worker should occur at higher educational institutions. The reinforcement of our science and industry with specialists and, consequently, our country's scientific potential as well largely depend on its successful completion.

11439
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FUNCTIONS OF COMPUTER CENTER DISPATCHER SERVICES DISCUSSED

Moscow EKONOMICHESKAYA GAZETA in Russian No 35, Aug 86 p 15

[Article by B. Panshin, head of a laboratory at the Ukrainian SSR Institute of Cybernetics imeni V. M. Glushkov, Kiev: "Surplus in the Presence of Shortage"; first paragraph is source introduction]

[Text] A significant potential of computer resources has now been created in the country. However, it is still used poorly. For example, in some cities, where a large number of computers are concentrated, their average load does not exceed 60 to 70 percent. At the same time, the surplus of computer resources among owners is coupled with their shortage among computer time clients. Special interdepartmental computer center dispatcher services help to put reserves to use.

The need for such centers has been demonstrated by practice. Obtaining data on reserves of computer time and the needs for it, they redistribute (simply speaking, sell) resources of departmental computer centers. Thereby, computer center dispatcher services not only organize the recording and control of the use of computers, but contribute to their fullest load.

For example, such a service operates in Kiev at the computer center of the statistical administration. Its efficiency confirms the following fact: During the 11th Five-Year Plan the computer center dispatcher service annually sold machine time worth more than 2 million rubles. However, annual expenditures on maintaining the new service were 300- to 400-fold lower.

The activity of the Kiev Computer Center Dispatcher System is fully automated. This has been done on the basis of the SM-4 minicomputer program package and methods of using it developed by the Institute of Cybernetics imeni V. M. Glushkov of the Ukrainian SSR Academy of Sciences. By means of the program package the dispatcher keeps the electronic card files of the computer center and the card files of machine time clients. He also determines the most efficient possibility of attaching consumers to a specific departmental computer center.

Today the computer center dispatcher service of the city of Kiev has accumulated an amount of information on the computer center, which makes it possible to solve various problems previously considered insoluble. For

example, measures aimed at reducing duplication in computer software developments have been prepared. The computer center's specialization in individual types of information computer services--either machine calculation, or data bank storage, or automation of design operations--is being introduced.

With the formation of the State Committee for Computer Technology and Informatics the problem of regulating the activity of computer centers and computer use has become a top-priority problem. The committee is entrusted with the responsibility for coordinating all work on the development, production, use, and servicing of computer hardware in the national economy. It seems that computer center dispatcher services could facilitate the execution of this task.

It should be stated that such services have been established not only in Kiev, but in the country's other cities. However, they operate at their own risk thanks to the efforts of enthusiasts. This is not enough. In fact, expensive computers are often bought for considerations of prestige. Organizations, which have funds at their disposal, at times accumulate computers without taking their own needs for computer resources into account. Moreover, no one, as a rule, is concerned about the preliminary training of service personnel for a two- and three-shift computer operation. It also happens that, when selecting types of computers and their configuration (set of central and peripheral devices), [organizations] are guided only by "peak" loads. The computer time seemingly is placed in reserve from the very beginning of operation and then remains unutilized constantly.

Of course, a computer can be loaded by enlisting outside partners or organizations in collective computer use. However, no computer owner does this, although the potential client can be quite nearby. As experience shows, such a consumer, not having computer resources at his disposal, is ready to use not only late evening, but also night, hours for computer operation. The computer center dispatcher service sometimes fills this gap successfully.

It seems that for greater benefit specific duties and rights should be given to the new services. After all, now they are unable to have an effect on, or apply economic sanctions to, those who are not concerned about a full computer load and sometimes even ignore this demand. Methodological guidance of organizations--computer owners--should also be entrusted to them.

For now computer center dispatcher services do neither. The problem also lies in the fact that they operate within the framework of different departments--where there is an attitude of understanding toward the saving of computer resources. Where have new services not been established! At territorial bodies of the Central Statistical Administration, as, for example, in Kiev, at city executive committees, and at regional departments of the All-Union Scientific Research Institute of Problems of Management Organization.

I assume that it is necessary to set a single task for computer center dispatcher services: To protect common state, not private and departmental, interests. Here, of course, it is impossible to manage without defining their functional duties on a legal basis. The following proposal also comes to mind: To make the computer center dispatcher service the basis for an

organized system of state control of the use and redistribution of computer resources.

In such a case it will also be possible to entrust them with the functions of intersectorial centers for operational technological application of new computers and new computer programs, as well as for the introduction of advanced methods of performing information computer operations. After all, the information processing industry is formed and developed on the scale of the country's entire national economy. Consequently, an appropriate organizational structure of the sector's management should also be formed.

In order to carry this out, it is necessary to subordinate computer center dispatcher services directly to the State Committee for Computer Technology and Informatics. Obviously, it should be a matter of establishing an overall system ramified throughout sectors and industrial centers, which ensures efficient management of computer resources. As practice show, for now it is advantageous to establish territorial computer center dispatcher services in regions (cities and oblasts), where computers are concentrated mostly. I would like to compare the proposed system with the unified dispatcher service of the USSR power network, which controls the distribution of power capacities in the country.

Another circumstance confirms the need for computer center dispatcher services. The decisions of the 27th CPSU Congress envisage a mass output and application of personal computers. The rapid development of local and distributed computer networks in one way or another predetermines the complications in the territorial administration of computer resources.

Of course, a multitude of problems arise with respect to the organization of computer center dispatcher services. For example, what indicators should evaluate their production activity and determine their return? How to stimulate the labor of associates? These and other problems can be solved, but they must be handled in earnest. The chief thing must be kept in mind: The activity of computer center dispatcher services is efficient. It makes it possible to more fully use one of the most valuable modern resources--computer operating time.

11439
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WORK ON AUTOMATED PARTICLE TRACK SCANNER RECOUNTED

Moscow NAUKA V SSSR in Russian No 5, Sep-Oct 86 pp 92-98

[Article by Doctor of Technical Sciences B. A. Utochkin, department chief at High Energy Physics Institute (IFVE), Serpukhov, "A Computer Which 'Doesn't Need' Digits"]

[Text] One of the key problems in high-energy physics is fast and reliable processing of data coming from an accelerator. But first let us see in what form it comes.

Any experiment with elementary particles, even the most original and sophisticated, ultimately reduces to isolating a particle of the required type, imparting it the greatest possible energy, colliding it with another (or waiting for it to decay spontaneously), and observing what happens.

To record these processes the region of space in which they occur is surrounded by numerous detectors of charged particles, which may sometimes come in thousands. The obtained information is then processed by computers. With optical data display detectors there is another option: an "event" (as physicists call a particle collision or decay) can be photographed, if it occurs within a bubble chamber, which is a vessel containing a liquid brought to boiling point. Just before an event is to be recorded the pressure in the chamber is increased sharply and the atoms ionized by a charged particle flying past them become boiling centers around which microscopic bubbles of gas form. They mark the particle's track and are visible to the naked eye. The chamber is placed in a constant magnetic field, which makes the tracks curve. From the degree of curvature it is possible to judge of the particle's mass and the direction of the curve indicates the sign of the particle, thus making it possible to identify it.

A photograph of tracks appearing in a bubble chamber is very graphic, and the physicist can see with his own eyes what happens to a particle when it decays or collides; he can, figuratively speaking, put his hand on the tree of tracks, feel each branch and, if he wishes, obtain a three-dimensional image of it. Such a stereoscopic photo is the experimenter's basic data document. But how does one decipher it to extract that data?

First the pictures are selected and marked. The experimenter chooses the ones he needs and marks the tracks that interest him. To determine how much a track has been bent by the magnetic field it is necessary to convert it into a series of numbers, refer it to a coordinate system, determine the coordinates

of selected points, and then use known mathematical formulas to compute the curvature. This is painstaking work requiring high concentration, refined skills and, most important, much time.

As long as accelerator energies were relatively low, and consequently the number of particles created in collisions was small, as long as the experiments were comparatively simple and did not require the reviewing of large arrays of "photographic" data, this drawback was tolerated. But conditions grew steadily more complex, and by the mid 1960's developed into a major problem. Today, when experiments may involve hundreds of thousands, if not millions, of "events," it would be simply impossible to perform them without automating the process.

To resolve this problem IFVE developed a universal computerized measuring unit capable of processing photographs from virtually any bubble chamber in the world.

The work proceeded in several stages. The first included studying the problem, familiarization with existing systems, and assimilation of the best Soviet and foreign experience. This was not some abstract research; our work was accompanied by specific physical experiments. At first the idea was to make simplified systems with minimal automation, something like a microscope with a small screen; this was to be followed by more complex systems, with the aim of ultimately producing an automatic measuring unit capable of processing photographic data obtained from large bubble chambers. At the time such chambers were still on the drawing boards, but it was already apparent that the photographs would be structurally much more complex, with correspondingly higher processing requirements.

We were all young when we began. It was back then, in the 1960's, that our basic principle of joint work evolved: "Only the common cause is right." No other considerations mattered in our relations. If someone was stuck with some problem it meant we had to sit down together, analyze it, find the best load distribution for various aspects of it: formulating the physical problem, software, hardware, etc. And, of course, no one ever felt offended if something better than you had thought of was proposed.

This style determined many things. It was, perhaps, thanks to it that we formed a team of many creatively and originally thinking people. That may be why we were able to find the right approach to the problem and ultimately develop a unique measuring system.

Of course, alone we could hardly have tackled such a task. We were helped at every stage. Many different enterprises were involved in designing and building the instruments. For example, in the optical department we collaborated actively with the Leningrad Optical-Mechanical Association (LOMA). It is no exaggeration to say that the whole country helped us to build our measuring unit. Moreover, those who collaborated with us also gained significantly. Thus, at LOMA the results of work on our contracts were later applied to other tasks, for example, in designing two-coordinate and then three-coordinate instruments for displacement measurement and later for automating them. In short, the set of instruments developed in collaboration with IFVE had a

qualitative impact on the development of a whole series of state-of-the-art devices needed by all and currently produced by industry. Among them are special CRTs with unprecedently high resolution (32,000x32,000 information dots per screen), high-speed oscillographs, graph displays, and many other instruments. Besides new CRT units, a number of existing ones were substantially modified. All this was made possible by the use of know-how and computation methods specific to high energy physics applied in designing electron and ion guns for the accelerator. Thus, while the whole country worked on IFVE's computerized measuring unit the whole country also benefitted tangibly, and equipment standards grew significantly in many fields.

Thus, the work was done jointly, but its center was, of course, at IFVE, where the main ideas originated.

By the mid 1970's IFVE had a whole fleet of various instruments for processing bubble chamber data. After accumulating a body of personal experience and overcoming an array of diverse and at times unexpected difficulties, we were finally able to precisely formulate the task, understand what we wanted of the future measuring complex, and picture its details. We already knew that the most up-to-date processing systems were automatic units with CRTs capable of computer-aided selective scanning. Such an automatic device has to be fast, operate continuously for 16 hours, during two shifts, and analyze 70x95-mm photographs with resolution of the order of one micron. We also understood how to ensure such precision. We also got into more general requirements. The system had to be universal and readjustable, since our institute carries out extensive joint studies with other nuclear research centers, each with its specific methods of obtaining photographs. That is, the methods are the same, the differences being in details, but they are so substantial that both the pictures and the processing requirements differ. And there was one more condition, perhaps the most important: the system not only had to be "compatible" with the camera but it also had to be "future-oriented," adaptable to measurement conditions of rapidly increasing complexity and eventually capable of handling pictures from chambers that are still on the design drawing boards. A machine was needed that would pay off for the tremendous labor invested in it and remain effective for a sufficiently long time to come. Realization of the importance of the latter requirement came to us at considerable cost: years of work on instruments apparently suitable for the given moment, but which quickly became obsolete. However, whatever the cost, it was paid.

Out of 12 models of units available to us at the time only two were really effective. The first was a table for initial photograph viewing. The familiar word "table" actually refers to a much more complex device: something like a huge, two-story photo enlarger with built-in computer and special electronic circuits. Its official designation is PUOS-4 (the Russian acronym for "photograph scanning instrument"). We had had "tables" before, but we needed better performance from the PUOS-4. Whereas available devices were capable of enlarging photographs not more than 10-fold, we needed 60-fold enlargement. To this day even the largest nuclear centers can rarely boast "tables" with such optical capabilities.

The second type of unit is an automatic measuring device. We called it MELAS, which stands for "modelling electron-beam photograph analyzer." Its design is based on a nontrivial idea which initially caused some bewilderment but was ultimately vindicated.

Broadly speaking, we wanted to make electronic circuits do the same things physicists did in the 1950's and 60's when they realized how tiresome manual "numbering" of photographs could be. Instead of numbering particle tracks and determining their curvatures they adopted a simpler approach: they assembled a huge array of french curves of different curvature, calibrated them, then superimposed them one after another on the measured track, selected the one that fitted and simply read out the required answer.

The curves are either stored in the MELAS memory or rapidly generated by it. A thin beam of light is passed through a photographic film; its position and, consequently, the position of the point highlighted on the photograph, can be controlled by the electronic circuits and the computer. The picture itself is transmitted via a television circuit onto a screen, from which the processing results are recorded. The operator positions the light beam on the end points of the measured track (or portion thereof), thereby assigning the machine the initial conditions, after which the curves are selected by having the beam trace lines of different curvature on the photograph. The beam passes through the film to a photodetector. If it passes by the track through the transparent portion of the film the signal in the photodetector is strong, when it passes through the track the signal is weak. The aggregate signal in the photodetector indicates how the curve coincides with the track. The machine selects curves until the "coincidence" signal reaches a maximum, projects the track on the monitor screen and proceeds to process the next track.

IFVE Workers first reported this principle in 1974, at an international conference on computerized image scanning in Oxford. The report evoked numerous puzzled questions. Experts in computer miracles were at first unable to comprehend how the machine, without extracting virtually any digital information about individual points of the image from the photograph, managed to process that information and, moreover, faster, more reliably and more precisely than all CRT systems before it. At the time many took a highly skeptical view of our project.

But just two years later, at a conference in Padua, the skepticism was finally dispelled, when we presented our idea embodied in hardware, electronics, optics, and convincing results. The MELAS analyzer was capable of what is known as image recognition, operating not with separate points but with image fragments. MELAS is, in effect, a device for inputting not only physical data, but any kind of graphic information. This achievement goes beyond the narrow boundaries of a specific physical experiment: it has a much greater potential and wider sphere of application, up to and including use in future artificial intelligence systems.

MELAS can both input and output any graphic information, using a light beam to reproduce any pattern in its memory on blank photographic film, moreover, with high accuracy and resolution (32,000x32,000 dots), making it suitable for producing photo micrographs with high information density.

An important feature of MELAS is that data processing takes place, in the language of the experts, in an interactive mode. In other words, the machine continuously tells the operator the stage of the process it is on and all the operator has to do is see that the computer is operating correctly, has made no mistakes, has not confused tracks or accidentally "jumped" from one to another. If necessary the operator can intervene and adjust the situation. Such an operational mode completely relieves him of routine operations, leaving to him what the machine cannot be required to do: creative, discriminating action and rapid evaluation of a contradictory situation. MELAS is but one of of the measuring devices' original processing systems.

It can be compared with a factory which manufactures processed photographs at a rate of 2,000,000 to 2,500,000 flat images a year. This number is our main indicator. In this parameter we surpass other world science centers. Our priority in processing speed and precision is also unquestionable.

Life changes rapidly, and what seemed to be state-of-the-art only yesterday may now be obsolete. Today we have to process photographs which a dozen years ago would have totally stumped any physicist with dozens of superimposed, intersecting tracks. And what about the future? In our institute the operating accelerator, which only recently was the most powerful in the world, will be supplemented with a new accelerator-accumulator complex (UNK) capable of accelerating protons to the almost fantastic energy of 3,000 billion electron-volts. That means it will be necessary to operate with even more complex experimental devices, handle huge streams of experimental data, and on the basis of accumulated experience resolve new creative tasks.

9681
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BULGARIAN COMPUTERS AND DATA-PROCESSING EQUIPMENT SPOTLIGHTED

Moscow PRILOZHENIYE K EKONOMICHESKOY GAZETE in Russian No 46, Nov 86, p 3

[Unattributed, untitled article written on behalf of the Bulgarian Foreign-Trade Organization "Isotimpex"; introductory paragraph in boldface]

[Text] The industrial development of the People's Republic of Bulgaria has seen the birth of new and advanced industries, the fastest-growing of which is the electronics industry.

The rapid development of the electronics industry required overcoming a number of problems having to do with importing the necessary equipment and its complementary parts and materials, as well as with the sale of the products being manufactured. In order to solve these problems, the foreign trade organization (VTO) "Izotimpex" was founded in 1968 and over time has become one of the biggest organizations in Bulgaria. Its functions include importing and exporting products, systems, and fully-equipped commercial plant and providing technical support services. Isotimpex serves a large number of ministries, agencies, commercial organizations, associations, institutes, and so forth, including the commercial organizations "IZOT" [expansion unknown (Bulgarian)], "Instrument Making and Automation", "YeMGE" [expansion unknown (Bulgarian)], and "Communications", the Ministry of Transport, and so on.

Isotempex' international business network is expanding, and commercial ties have been established with partners in over 60 countries. Several jointly-owned firms and a technical support and service agency have been established abroad. Isotempex' scope of activities can be characterized with two statistics. The volume of sales made abroad accounts for nearly 60 percent of the deliveries completed by the electonics and electrical equipment industry and more than nine percent of Bulgaria's total exports.

During the course of the last five-year plan, Bulgaria signed 26 contracts and agreements governing specialization and cooperation in the production of goods including those listed in the nomenclature of Isotempex. This has been a factor in increasing production efficiency. The technical and economic indicators and the quality of the goods exported have improved concurrently with a reduction in imports of similar products from non-socialist countries.

The types of goods exported through Isotimpex include a wide range of systems and hardware, midicomputers, minicomputers, central and specialized processors, magnetic-tape storage devices, tele-processing systems, specialized electronic networks, and electronic calculators, typewriters, cash registers, and similar products.

The IZOT 1036S and 1037S 16-K specialized micro-computers are integrated with standard operating systems and interfaces (serial, parallel, and network). These computers can be expanded with up to 20-megabyte hard disk drives, up to 640K Bytes in drives, floppy disk drives, dot-matrix printers, and boards for linking up with local and telecommunications networks. The wide selection of software ensures that these computers can be used in various economic, scientific, and engineering applications.

These microprocessor-based systems can help enterprises improve their performance, automate administrative functions, and manage information on various levels. Using these machines for word processing significantly increases the productivity of typing, secretarial, and editing personnel, and simplifies a manager's work.

The ELKA 93 electronic cash register was designed for aiding the managerial and financial personnel of hotels, motels, and other establishments. As a programmable cash register with a flexible and modifiable set of functions, it allows its user not only to store all of the information needed, but also to respond quickly to the business-related and organizational variables of reprogramming the quantitative correlations between the individual functions, (services, billing, booking rooms, and so forth).

The ELKA 82 cash register is designed for all types of commerical applications and has a wide range of functional possibilities, including simultaneous processing of data input by multiple users.

The Pravets family of personal computers is distinguished by its great versatility. The Pravets-16, for example, works with a wide range of standardized software such as electronic spreadsheets, word processing, data bases, and graphics. The Pravets 8M personal computer is the mainstay of the mass-produced computers. It is widely used not only in educational institutions, but also by economists and production managers, for computer-aided design, and for automating scientific experiments. The Pravets 8D home computer is also quite popular and is designed for educational and entertainment purposes.

Nearly 80 percent of the domestic demand for measuring equipment, process-control instruments, and automation devices is met by the distribution of products in accordance with the contracts and agreements covering specialization and cooperation in production between socialist nations, mainly the USSR. A 15-percent increase over the next five years is slated for the list of specialized products.

Cooperation between Bulgaria and the USSR is a top priority; trade relations between the two nations is expanding on the basis of long-term agreements on cooperation and specialization in the areas of computer technology, componentry,

instrument manufacturing, and components distribution. Specialization and cooperation in production is slated to expand and become more concentrated.

Bulgarian organizations support commercial ties with Soviet enterprises via the Elektronorgtekhnik [Electronic Business Equipment], Mashpriborintorg [Machinery and Instruments Imports and Exports], Mashinoimport [Machinery Imports], Tekhmasheksport [Textile Machinery Exports], Soyuzglavpribor [Main Administration for the Supply and Sale of Instruments], Soyuzzagranpostavka [All-Union Association for Delivering Goods Abroad] All-Union Associations, the Ministries of Foreign Trade and Instruments, Automation Equipment, and Control Systems, and others.

The majority of electronic products is jointly developed with Soviet research and development institutes, with specialists from both countries making an active contribution. Production of the goods is also started on a joint basis.

The Soviet 1033/1045 computer has a good reputation in Bulgaria. Soviet systems and automation instruments are working in many Bulgarian industrial processes.

Isotimpex and its Soviet sister organizations are working hard on the preparations for establishing commodity-exchange programs during the next five-year plan.

Close cooperation between the commercial organizations of our nations and the efforts to expand trade and strengthen the economic ties between our countries have a single purpose -- to increase the economic potential of our nations.

13050
CSO: 1863/146

UDC 681.326

DIAGNOSIS OF MICROPROGRAM CONTROL UNIT OF MICROPROGRAMABLE MICROPROCESSOR SYSTEMS

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 3, May-Jun 86 (manuscript received 27 May 85) (21 Nov 84) pp 87-94

[Article by V. N. Balakin, A. S. Kalendarev, V. P. Kryukov, Yu. Ye. Usachev and L. A. Shumilov]

[Abstract] An analysis is presented of methods of applying signature analysis to the diagnosis of a microprogram control unit and related problems of microprogram conversion and analysis of microprocessor system structure with various signature analysis connections. Three methods of using signature analysis for diagnosis of microprograms are distinguished: Production of the signature of a sequence of microinstructions in straight-line portions of the microprogram; production of the signature of a sequence of microinstructions in microprogram portions consisting of a straight-line portion and one conditional transfer; and production of the signature of an arbitrary microprogram section containing both conditional and unconditional transfers. Flow charts are used to analyze microprogram sections. It is found that the signature analysis method must be determined by the degree of conveyerization of the structure being diagnosed, speed of diagnosis and its haredware costs.
Figures 4, references 9: 7 Russian, 2 Western

6508
CSO: 1863/160

UDC 681.32:519.713

DESIGN OF COMBINATION DEVICES BY LINEARIZATION METHODS

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 4, Jul-Aug 86 (manuscript received 5 Aug 85) (6 Mar 85) pp 77-86

[Article by A. N. Sychev]

[Abstract] A study is made of the possibility of optimal implementation of combination devices based on matrix LSI (MLSI) devices. It is assumed that the combination devices represent various classes of logic functions differing in their symmetrical properties and degree of definition. The common theoretical apparatus for the solutions suggested is linearization. The methods are illustrated using a MLSI device implemented with low-signal-current switches. The problem of linearization is solved by isolating a class of logic functions effectively implemented in MLSI devices and selecting the corresponding linearization criteria so that functions in the class selected are represented in the nonlinear portion. Factorable functions containing terms with common multiples are convenient from this standpoint.
Figures 6, references 9: Russian

6508
CSO: 1863/161

UDC 681.142

SIMULATION OF A MULTIPROCESSOR COMPUTER SYSTEM WITH HIERARCHICAL MAIN MEMORY

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 5, Sep-Oct 86
(manuscript received 19 Nov 85) (1 Jul 85) pp 49-60

[Article by O. M. Brekhov and A. I. Slutskin]

[Abstract] A study is made of an algorithm for servicing the requests of processors in a multiprocessor computer system with hierarchical memory when the processors utilize several RAM cache buffers as a common resource. The method of simulation is used, allowing a detailed description of the system investigated in that the model simulates not only the behavior of the system, but also its structure and the operating load, which is specified in detail. The program structure model considered the following parameters: Number of modules, structure of operation of program modules, module size and module structure. The decrease in throughput of the computer system upon failure of processors or cache buffers is determined. The model supports planning tasks related to determination of the influence of the organization and technical implementation of the multiprocessor computer system structure on computer system throughput. Utilization of the working load model allows determination of the influence of program characteristics on computer system throughput, thus refining recommendations for composition of programs. The model was used to determine the throughput of the YeS 1065 computer with various configurations of the machine and organization of memory hierarchy.
Figures 7, references 13: 7 Russian, 6 Western

6508
CSO: 1863/162

UDC 681.3.48/14

ALGORITHMIC METHOD OF DESIGNING OPERATING STRUCTURES OF ELECTRONIC DIGITAL COMPUTERS

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 5, Sep-Oct 86 (manuscript received 22 Apr 86) (01 Oct 85) pp 72-76

[Article by M. A. Gladshteyn]

[Abstract] A method is suggested for designing the operating devices of electronic digital computers in which the ALU is divided into sections of k binary digits. Elimination of the shortcomings inherent in traditional ALU design can be achieved by representing operations not through functions in Boolean algebra, but rather by algorithmic means. A flow chart illustrates the breakdown of the ALU functions into elementary functions such as add, AND, bit shift, etc. Each branch represents the algorithm for performing a specific operation, including one or more steps. Each step in the algorithm can in turn be reduced to formation of the output signals of the ALU by performing certain mathematical actions. This process can also be described by an algorithm. The algorithmic method of ALU design has yielded nontraditional ALU's when applied at the Andropov Aviation Technology Institute under the leadership of the author, resulting in the award of a number of authors certificates. Figures 6, references 13: Russian

6508
CSO: 1863/162

UDC 681.326.3

PARALLEL LOGIC CONTROLLERS IMPLEMENTED ON THE BASIS OF STANDARD PROM DEVICES

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 5, Sep-Oct 86 (manuscript received 26 Nov 85) pp 77-82

[Article by I. A. Furman]

[Abstract] The All-Union Scientific Research Institute of Electric Machine Technology has been developing the principles of structural organization of a programmable logic controller, the speed of which is independent of the number of inputs-outputs serviced. The device can utilize languages in which the users of the equipment controlled ordinarily formulate logic control programs, languages such as technological cycle graphs. Three requirements were considered in developing the language and technology of programming the programmable logic controllers: 1) The language and its application must be simpler for nonprofessional users than those traditionally used in programmable logic controllers; 2) The language should be psychologically natural, based on bringing the programming language as close as possible to the language of the user of the technological equipment; and 3) The language should be universal in the sense that the same language can be used to describe the behavior of the controlled object, control algorithm for the object and for programming of the controller. A tabular form of recording technological cycle diagrams was selected as the basis of the programmable logic controller language. The syntax and semantics of the language have been developed. In comparison to known controller languages, the new language must be considered an expanded version of microprogramming languages with fixed (tabular) placement of symbols and words. The basic difference of the new language from such languages as MIDAS is that the older languages were intended to describe the composition and sequence of microinstructions in the microprogram and contain no operators or rules for description of the procedure of testing the status of the controlled object and computer system.
Figures 2, references 9: Russian

6508
CSO: 1863/162

SOCIAL INFORMATION AND THE COMPUTER

Moscow TEKHNIKA I NAUKA in Russian No 7, Jul 86 pp 18-19

[Article by E. Burdyukova, Dnepropetrovskiy Oblast Board for the Ferrous Metallurgy Scientific and Technical Society, and V. Khokhlov, candidate of technical sciences, Main Computing and Data Processing Center of the UkSSR Ferrous Metallurgy Ministry; first paragraph in boldface in source]

[Text] The "Sociology" subsystem functions as part of the sector automated management system of the UkSSR Ferrous Metallurgy Ministry. The All-Union Council of Scientific Engineering and Technical Societies has endorsed the experience gained during its operation and has recommended its extensive implementation. This experience is the subject of the present article.

It is difficult to overestimate the significance of social information as scientific and technical progress accelerates and the economic system is reorganized and advanced. In fact, without reliable information it is impossible to correctly ascertain the causes of labor turnover, the factors that induce occupational disease and the underlying causes of breaches in labor discipline.

It is impossible to correctly allocate funds for dwelling construction, travel authorizations for treatment at medical and health care facilities, etc. Correct decisions can not be made and everything necessary for the optimal utilization of labor resources can not be brought into being without such knowledge. Scientists have proposed the use of automation for the obtainment of precise and effective social information.

Many difficulties arise at the start of any new endeavor, and we were not spared them.

Almost immediately the developers ran into a number of problems. Firstly, the use of powerful computers is not always economically expedient. Secondly, the previous YeS computer information processing technology made it impossible to efficiently utilize the machine or interact with it at any moment, in order to enter additional data, for example, or correct and compare them, and produce the required forms upon demand. It became necessary to expand the range of tasks executed by the computer and to improve the interaction with it. Microelectronics helped here. The Dnepropetrovskiy Oblast Board for the

Ferrous Metallurgy Scientific and Technical Society (NTO) initiated the use of domestic microcomputers to process social information. The presidium of the NTO board, relying on the opinion of specialists, made the decision to base the developers' work on the "Iskra-226" computer. This relatively inexpensive machine allows the untrained user to not only enter and output data on a display and printer, but to develop application tasks without programming skills. Applied program packages promote system flexibility.

In 1984 the Main Computing and Data Processing Center of the UkSSR Ferrous Metallurgy Ministry with the assistance of the oblast board of the ferrous metallurgy NTO prepared and began to implement a social duties automation program with the "Iskra-226L" computer. The solutions of which tasks have the highest priority? Specifically, a large set of problems in reporting and analyzing the status of dwelling and everyday repairs and other services for the workers of the sector's plants. The solution to problems of monitoring total dwelling floor space commissioning, determining the demand for dwellings and of a number of other problems made it possible to adopt timely decisions aimed at fulfilling construction and dwelling repair schedules, and to develop recommendations for the optimal allocation of dwelling construction funds.

All of the collective social development management tasks developed on the microcomputer are solved with the consideration of possible extension and modernization, and can be used in other sectors of the economy.

Automated social process administration methods will be developed in the 12th five-year plan for the ferrous metallurgy plants of the UkSSR, in particular, for compiling social development plans for the collectives. At the present they are not always balanced in terms of material, labor and financial resources and do not consider all social factors, in contrast to economic development plans. Why? This results from the great diversity and complexity of characteristics and their interconnections. The extensive use of the microcomputer makes it possible to solve such problems. Here the microcomputer can be used for the primary processing and outputing of information, while large computers store and process primary files.

The "Occupational Safety" multilevel subsystem is already being developed. Here the tasks will be simultaneously solved at the plant and sector level. The point here is that temporary disability losses have not been reduced at all plants as occupational safety expenditures have increased. This means that the funds allocated for occupational safety are not always effectively utilized.

The microcomputer will be used at the plants to make a comparative analysis of the temporary disability loss level throughout all subunits and compute the dynamics of the variation in outlays for the construction of safety installations and improving working conditions; they have been used to reveal work places with the highest occupational disease rate and to implement the appropriate, requisite measures. Final optimization calculations make it possible at the sectorial level to reveal variants by which occupational safety funds are allocated to subunits. All elements of the subsystem are now ready; thus the UkSSR Ferrous Metallurgy Ministry, the republic trade union

committee and medical workers can receive the requisite data for their work in improving working conditions and safety techniques. This is already being put into practice.

The automated analysis of medical documents makes it possible to discover work places in which the working conditions cause occupational diseases, and to take the requisite measures. Work in this area has been successfully accomplished at the Dnepropetrovskiy Pipe Rolling Plant im. Lenin and Metallurgical Plant im. Petrovskiy.

What today stands in the way of more fully utilizing microprocessor devices? One factor is the poor training of administrative and trade union personnel, and occasionally the insufficient attention directed to social process management automation by plant directors. The solution to this problem requires a bilateral effort: The administrative organization and trade union workers must be given the necessary knowledge and aid in assimilating the basics of informatics, while the sector computer center specialists must study the basics of social work and social process characteristics and recognize problems and difficulties.

The "Iskra-226" is, in essence, a personal computer, and the specialists of the Main Computing and Data Processing Center have proposed the creation of user automated work stations.

Special microprocessor device assimilation courses have been organized for the workers of the Ferrous Metallurgy Ministry plants and trade union workers upon initiative of the oblast board of the ferrous metallurgy NTO. A seminar and competition for the best application of personal computers is being planned for 1986 by the oblast NTO board with the goal of exchanging experience.

The advantages of the automated processing of social information with personal computers are obvious. The support of this trend and its development in every way possible are the urgent tasks of the NTO.

12678
CSO: 1863/6

IMPROVED COMPUTER USE IN ARMENIAN CHEMICAL INDUSTRY URGED

Yerevan KOMMUNIST in Russian 13 Oct 86 p 2

[Article by A. Tatevosyan, chairman of the section of chemical cybernetics under the Republic Board of the All-Union Chemical Society imeni D. I. Mendeleyev: "Computer and Experiment"]

[Text] Intensification of existing production facilities and units for the purpose of optimizing and automating technological processes is one of the serious problems in the chemical industry.

Application of cybernetic methods and means of computer technology is the key to solving this problem. A large-scale scientifically substantiated transition from the laboratory to industry is its most important aspect. It is clear why equipping a chemical laboratory with a computer is so vital. All research should be conducted according to an automated experimental system.

The June (1986) Plenum of the CPSU Central Committee noted that proper attention was not paid to the development of a scientific research and experimental base. This had an effect on the rates of scientific and technical progress. Sectorial scientific research institutes, as well as academic institutes, where fundamental research is conducted, are not equipped with an automated experimental system.

Development of information retrieval systems for different purposes is another important problem, on which we would like to focus attention.

Work on establishing data banks is carried out in the republic. For example, a data bank for calculating the properties of substances and their mixtures was established and introduced at the Yerevan Department of the Okhtinsk Plastpolimer Scientific Production Association. It also makes it possible to describe the properties of substances for which there are no experimental data. A computer data bank, which has at its disposal information on nearly all "small-scale chemical industry" products produced in the country, is being developed at the Armenian Affiliate of the All-Union Order of the Red Banner of Labor Scientific Research Institute of Chemical Reagents and Highly Pure Chemical Substances. In only a few seconds, conducting a dialog with the computer, it is possible to obtain the necessary information on any product--its properties, raw materials, and methods of producing it.

Similar operations are carried out in many organizations. However, the lack of departmental coordination creates duplication and leads to an inefficient use of computer complexes. Right now it is necessary to take energetic measures to establish collective-use data banks at one computer center, which will service many organizations. Centralization will make the operation of computer centers and individual enterprises more efficient and will create the possibility of exchanging information.

The design stage is one of the most important stages in the technological life cycle. Traditional manual design methods do not make it possible to use modern methods of synthesizing, analyzing, and evaluating all the variants of technological and engineering solutions. The development of the automated design system determines the prerequisites for the realization of man-machine design technology. It is free of the shortcomings of traditional technology and has a number of advantages: It sharply improves the quality of planning and design work. It is carried out in a short time, reducing human resources.

Nine design subdivisions of the chemical industry operate on Armenia's territory. In practice, however, not one of them uses computer hardware.

A technical conference of managers of design subdivisions at republic organizations of the Ministry of Chemical Industry was held in Yerevan as long ago as 1979. It decided to organize a multiple-user automated design center at the base of the Yerevan Department of the Okhtinsk Plastpolimer Scientific Production Association. This head organization of the Ministry of Chemical Industry was staffed with appropriately skilled specialists and equipped with computer hardware.

Appropriate machine complexes were developed and systematized in a short time. At present, however, this work has been reduced to a minimum. Managers of the mentioned design organizations refuse to use the services of this center. The republic's Gosplan should have its final say in this matter and make it incumbent upon all organizations to execute design developments with the use of automated design systems.

The automated design system represents an urgent need for our republic and measures should be taken to expand it further. There are also real possibilities of transforming it into a Transcaucasian Branch Center.

Automated management systems have been developed and introduced into production at rapid rates at the republic's chemical industry enterprises in recent years. For example, the first stage of the Nairit Automated Management System has been developed and is at the introduction stage at the Nairit Scientific Production Association. It performs numerous functions concerning centralized control of the most important parameters of production facilities, equipment operation, and so forth. Program packages for recording personnel and material and technical assets and calculating technical and economic indicators successfully operate on the basis of a computer at the Polivinilatsetat Production Association. Control of the execution of documents is automated fully. Automated control systems for marketing products and calculating workers' wages are now being introduced.

Today no one disputes the need for the electronization of the chemical industry. However, an expansion of work on the use of computer hardware in scientific and planning-design developments in industry is hampered by the lack of appropriate knowledge on the part of a wide circle of scientific and technical personnel.

To develop specialists capable of managing modern chemical production or successfully working at scientific and planning organizations, it is necessary to give students at institutes appropriate knowledge in methods of mathematical modeling, optimization, planning of experiments, and designing. Programming methods should be perfectly studied at higher educational institutions. However, graduates' knowledge in this area is obviously insufficient.

Computer hardware should be used in all student training links, be it the preparation of a course and a diploma project, or research--these are today's demands, which are already inherent in new programs of higher educational institutions. It is necessary to equip on a priority basis appropriate departments with modern computers and, if possible, to revise methods of education in a short time.

Furthermore, it is time to organize at the Yerevan Polytechnical Institute a center under a certain department (or even a separate department), which will be the base not only for training students, but also for retraining specialists in the national economy. The institute has all the prerequisites for this--skilled specialists and a rich material and technical base.

Big and responsible tasks face the country during the 12th Five-Year Plan. The materials of the June (1986) Plenum of the CPSU Central Committee show this with great persuasive force. To raise the organization and management of technological processes to a qualitatively new level and to begin training new types of specialists are the tasks of the day. The development of man-machine interactive systems of scientific research and automated design and management of production will ensure an acceleration of scientific and technical progress in the national economy. The solution of these problems requires close cooperation among higher educational institutions, science, and production.

11439
CSO: 1863/58

BEST OPERATORS FOR COMPUTER SYSTEM OF UKRAINIAN SSR CENTRAL STATISTICAL ADMINISTRATION

Moscow VESTNIK STATISTIKI in Russian No 9, Sep 86 pp 45-52

[Article by Z. Krichevskaya, department head of the Statistical Administration Computer Center, Volynskaya Oblast]

[Text] The All-Union Socialist Competition of Workers of the Top-Level Occupations for the Title "Best Operator of the Computer System of the USSR Central Statistical Administration [USSR TsSU]", in which more than 85,000 operators participate, is one of the most popular forms of Socialist competition in the USSR TsSU.

Sixteen of the 82 operators who won the all-union Socialist competition among the workers of top-level occupations for 1985 are operators at the computer centers and stations of the Ukrainian SSR TsSU. All of them are of outstanding workers of Communist labor, and many are winners of republicwide contests of operator skill and have been awarded "Outstanding Worker of the 11th Five-Year Plan" badges.

Naturally, each operator has his or her own method of working and own professional techniques that make it possible to improve labor productivity and fulfill established quotas in shorter times. We will talk briefly about those winners who are currently working at the computer network of the USSR TsSU.

Ye. Skipa has worked at the Voroshilovgradskaya oblast computer center [VTs] for 9 years and has mastered the ETR-220 computer and studied the Askota-314 and Robotron-1373.

Yevdokiya Aleksandrovna has worked out techniques that make it possible to work accurately and with good quality and to use work time more efficiently and switch from one operation to another quickly. She has used a set of efficient methods in her work, in particular, multiplication by a common multiplier, which ensures that the total time for completing complex computations is reduced significantly and that the probability of errors during keying is reduced. Moreover, she uses the memory in an electronic keyboard computer [EKVM], which makes it possible to make computations, calculate a sum, or the difference of products and remainders together, etc.

For convenience, the operator performs all operations with a plus sign first, and those with a minus sign next.

When obtaining consolidated reports, she uses the efficient procedures of turning under and folding the first doument into dividing lines between two columns with subsequent bilateral collation.

Ye. Skipa has systematically surpassed the output norm by 38 to 40 percent and fulfilled the quota of the 11th Five-Year Plan on 12 Nov 1984. She is a teacher of youth and outstanding worker of Communist labor. She has been awarded the "Outstanding Worker of the 11th Five-Year Plan" badge.

Ye. Reznichenko is an operator of the output group at the Statistical Administration VTs of the Dnepropetrovskaya oblast. Working since 1957, she has mastered the adding machines, card-punching machines, and computers. Since 1984, she has worked in an integrated brigade. Her main acitivity is checking the correctness of punching with respect to the accounting of wages and material values, as well as the output of tabulated forms to be sent to clients. The operator willingly gives her professional "secrets," knowledge, and accumulated production experience to youth. She surpasses monthly output norms by 50 to 60 perent. She fulfilled the quotas of the 11th Five-Year Plan in September 1984.

I. Grin is a punch group operator who has worked at the Vinogradovsk Regional Computing and Data Processing Center [RIVTs] of the Statistical Administration of the Zakarpatskaya oblast for 16 years. Before beginning to work, she checks the correctness of the adjustment of her machine for the punchcard template, comparing the punchcard with the prototype, and then checks to see that the holes have not shifted. To a significant degree, the labor productivity of an operator depends on the quality of the documents being processed, a thorough knowledge of the punching prototype, and the arrangement of the necessary data items in the documents. The constant features are provided for and the punching is done automatically, which reduces its labor intensiveness significantly.

The correctness of the punching of the constant features is checked by examining the holes "in the light." One mistake frequently encountered during punching is the absence of zero holes in the data items. To avoid this, a special program has been compiled to punch them automatically.

The transition to the brigade form of organization and stimulation of labor that began in January 1985 has placed new tasks before I. Grin and her friends. The integrated brigade that she heads works on Zoyemtron-415 card-punching machines and a YeS 9004 device for preparation of data on magnetic tape [UPDML]. The principle of combining occupations and their interchangeability is used widely in the brigade. The former assignment of operators to clients has been eliminated, and all operators process documents, depending on their arrival. The brigade has a good microclimate and feeling of good will, and workers pay attention to their relations with one another.

Before the brigade was created, operators generally fulfilled their output norms by 105 percent. Now, they surpass them by 115 to 120 percent, and

brigade has fulfilled the plan for the volume of work in the final year of the 11th Five-Year Plan before 10 Dec 1985 and has fulfilled the 2-month production plan of the first year of the 12th Five-Year Plan before the opening day of the 27th Congress of the CPSU. N. Ignatova came to Statistical Administration VTs in 1976 after completing training at the Zaporozhskaya oblast educational combine of the UkSSR educational and production combine [UPK]. She has mastered working on all models of adding machines and computers and, later, on invoice machines. Natalyya Ivanovna studies and analyzes documents turned over for processing and quickly finds imprecisions and errors in them.

Preparation of the workstation and the accurate working of machines are of great importance in increasing labor productivity. In the beginning of a shift, she checks her machine for correctness of calculation so as to avoid discovering errors due to machine malfunction at a later time.

Carrying out the fundamental operating rules has become the norm for her.

Knowing the operating capabilities of machines and knowing how to correct minor technical malfunctions in them facilitates carrying out operations effectively. She willingly shares her experience with other workers and gratefully accepts all new and advanced know-how. She is a teacher of youth and tries to give them her love for her occupation.

In the opinion of O. Burgart, an operator at the VTs of the Ivano-Frankovskaya oblast Statistical Administration, knowledge, experience, and knowing how to distribute one's time efficiently are the main landmarks on the path toward high-quality completion of tasks. She was one of the first in the oblast to support the initiative "For Work From the First Presentation."

She began her working life in June 1977 as an operator of Askota-170 bookkeeping machines. Knowing well that successfully accomplishing tasks that are becoming more complex by the day means not resting on prior experience, she has studying EFA-385 invoicing machines, Robotron-1720 EFBM [electronic accounting machine], and Robotron-1373 electronic data preparation device [EUPD], and then the Iskra-555 and Neva-501 in 1985.

O. Burgart tries to be one of the first to assimilate new technology and then trains her comrades in the brigade that she heads. A good teacher, she has raised nine young operators, illustrating the point by personal example.

The collective of the brigade that O. Burgart heads was named the winner in a Socialist competition between brigades of the VTs based on the results of work for 1985. A working atmosphere reigns in the brigade. Helping one another and lending a hand are characteristic for its collective. Here the output norm is surpassed every day, on an average by 120 percent. This is no small credit to the brigade.

A good knowledge of primary documents and the data items arranged in them speaks positively for the quality of work completed. The utmost atentiveness, conscientiousness, and speed in work make it possible for O. Burgart to use advanced techniques. Performing her job of entering wages on an Iskra-555

computer, she has somewhat changed the technology for processing this type of accounting document in order to save time. Thus, the wage entry indicators are gathered first, and then the other operation is completed during the automatic printout on a Robotron-1373 EUPD or Robotron-1720 EFBM, etc.

Every month, O. Burgart surpasses her production quota by 135 to 140 percent and fulfilled her quota for the 11th Five-Year Plan by 135 percent and by 138 percent in 1985. Based on the results of the last 5-year plan, she was awared the title "Young Guardsman of the Five-Year Plan" by the All-Union Lenin Komsomol [VLKSM] Central Committee, and based on the results of the Socialist competition in honor of the 50th anniversary of the Stakhanov movement, she was awarded the Honorary Diploma of the USSR TsSU and Central Committee of the Trade Union of Workers of Government Institutions.

L. Martsina works as a computer keyboard operator at the Znamenka City Information and Data Processing Station [GIVS] of the Statistical Administratin of the Kirovogradskaya oblast since the day it was organized in 1966. In her 20 years of activity, she has mastered the Zoemtron-220 computer, Askota-170 bookkeeping machine, and Askota-170 adding machine. She surpasses her output norms with excellent quality every month by an average of 160 percent.

Lyudmila Vasilyevna shares the fine points of her work with youth as their teacher, and she has been an outstanding worker of Communist labor since 1969. She takes an active part in the social life of the collective and is a winner of Socialist competition and contests for the titles "Best in the Occupation" and "Outstanding Worker of the 11th Five-Year Plan."

The operator filled the plan of the 11th Five-Year Plan before 22 Apr 1985.

Having taken an active part in the Socialist competition for early accomplishment of plan quotas for 1986 and the 12th 5-Year Plan as a whole, L. Martsina supported the initiative of the advance collectives of the oblast and obligated herself to fulfill the five-year plan in 4.5 years.

In 1971 V. Parashenko began working at the Odessa GMSS [city machine calculating station] of the Statistical Administration of the Odesskaya oblast as an operator-trainee in the card-punching shop and quickly assimilated this specialty. She uses advanced operating methods on the PD-45-2 card puncher, including manually setting and punching any digit from the 11th and 12th column in one column of the punchcard by the piece and automatically punching repeated information by fixing the set and other operations.

She surpasses the output norm by 150 to 165 percent. Her percentage of errors is minimal, which provides a great savings in punchcards. She is a brigade leader and outstanding worker of Communist labor, has assimilated related occupations, has been a teacher of youth since 1980, has trained 22 operators, has been awarded certificates and monetary prizes, has our gratitude, and has been put on the Board of Honor.

O. Makovetskaya has worked as an operator at the VTs of the Statistical Administration of the Kharkovskaya oblast since 1979. In 1982 she became a

part of the complex brigade of the card-punching machine section. She quickly mastered the occupation of operator of Zoyemtron-415 and Zoyemtron-425 punchcard computers [PVM].

On average, she has exceeded her output quotas by 135 percent with an excellent quality of work. For high indicators in the Socialist competition, she was awarded the Honorary Diploma of the USSR TsSU and Central Committee of the Trade Union of Workers of Government Institutions in 1984 as well as the Honorary Certificate in Honor of the 40th Anniversary of the Great Victory. She has won first place in the contest of operators of the oblast the title "Best in the Occupation" more than once. She was awarded the tile "Outstanding Worker of Communist Labor." She surpassed the planned quotas of the 11th Five-Year Plan and the accepted Socialist duties before 1 Dec 1984.

She is continually working to achieve the greatest productivity with the least labor expenditures. The has learned the operating capabilities of machines and document-processing technology thoroughly.

Arriving at work, she prepares her workstation, studies the documents on which she will be working, analyzes her instructions in detail, and makes sure she has a supply of punchcards for completing her shift jobs.

When working with documents, she doesn't only see digits in them, but also the end result of the work of the total brigade.

The times and quality of completed operations depend on the quality of the documentation completed. When the customer completes documents with poor quality or without filling in all necessary data items before sending the documents to the next stage of the production process, O. Makovetskaya inspects the group of documents and corrects the errors let through by the customer. The timely discovery of imprecisions makes it possible to work in a thorough manner and to avoid upsetting the schedule for processing documents in other sections.

A good knowledge of the operating capabilities of a machine and the know-how to eliminate insignificant technical malfunctions also facilitates the effectiveness and quality of the jobs being carried out. Before beginning to work, as well as periodically during her shift, she checks to see that her machine is in good working order so as to avoid decentering the punchcards. O. Makovetskaya was awarded the title "Outstanding Worker of the 11th 5-Year Plan" by the resolution of the college of the Ukrainian SSR TsSU and the Presidium of the raykom of the trade union of workers of government institutions.

She has the personal trait of thriftiness. In 1985 she saved 20,000 punchcards. She was the winner of the competition among Komsomol members of the statistical administrations of the oblast of the right to sign the report to the 27th Congress of the CPSU. In 1986 she accepted increased Socialist duties to complete the yearly planned quota and Socialist duties ahead of time before the 69th anniversary of the Great October Revolution. The brigade in which O. Makovetskaya works was awarded the honorary title "Collective of Communist Labor."

Based on the results of work for the first quarter of 1986, the brigade took second place in the Socialist competition among brigades of the computer network of the Statistical Administration of the Kharkovskaya oblast and is currently working on fulfilling increased Socialist duties for early accomplishment of the 1986 plan and 12th Five-Year Plan.

N. Shapovalova has worked at the Krasilovskaya RIVTs of the Statistical Administration of the Khmelnitskaya oblast since 1972. She has successfully assimilated adding, bookkeeping, and card-punching machines as well as computers.

Having done a wonderful job studying documentation-processing technology, she learned how to use and apply advanced techniques and methods. She works with a high output, uses each minute efficiently, and attains high production indicators. She surpasses output norms by 130 to 135 percent. She handled the plans and quotas of the last five-year plan successfully. She completed the quota of the 11th Five-Year Plan ahead of time, by 7 Dec 1985. She is an Outstanding Worker of Communist Labor and was a winner in the oblast Socialist competition in honor of the 40th anniversary of the victory in the Great Patriotic War. She has been awarded with honorary certificates and put on the Board of Honor of the RIVTs for high production indicators more than once.

Applying maximum efforts to finding reserves for increasing labor productivity and reducing document-processing times, Natalyya Alekseyevna developed an efficient "map" method of computing wages and fuel whose use made it possible to accelerate the document-processing process. She shares her work experiene with her comrades, helping them assimilate the production process, acquire professional skills, and increase their mastery. She is a teacher, and during her work at the RIVTs, she has trained 28 operators.

Since the brigade form of organization was introduced and labor at the RIVTs was stimulated, she has worked in a complex brigade that has been mentioned as one of the best oblast computing and data processing brigades since 1985 and has been awarded the Honorary Diplomas of the statistical administration and obkom of trade unions of workers of government institutions. Since January 1986, Natalyya Alekseyevna has been chosen as leader of this brigade and has completed her work on time and with high quality. The brigade leader monitors for careful adherence to the customers' schedules and takes measures to ensure that they are kept as stipulated in contracts and keeps a logbook on the savings of material resources. In 1985, 15,000 punchcards were saved on account of a reduction in the percentage of waste, and 10 kg of paper tape was saved on account of repeated use.

Natalyya Alekseyevna takes an active part in the social life of the collective. She is a member of the trade union committee and editor of the wall newspaper. Her collectedness, organization, and conscientious relation to work and to her commission have become her life's creed. It is precisely these qualities that have made her a leader of Socialist competition and have enabled her to attain high production indicators.

G. Kirenkina has worked as an operator at the Ichnyanskaya RIVTs of the Statistical Administration of the Chernigovskaya oblast since April 1975. She began worked in the card-punching shop. She has taken much from the multiyear experience of her teacher, operator G. Odnolko, the main thing being that properly organized work time, interruptionless operation of computer technology, and a clear rhythm in the production process are a reserve for growth in labor productivity. From the transition of processing documents with a PVM to processing them on an M 5100 computer complex [VK], she began working in the adding machine shop. The experience and knowledge that she acquired in the tabulation shop prepared her for a new place. Her thorough knowledge of the documents arriving for mechanized processing and ability to sense their meaning rather than simply seeing digits in them play a very important role.

Galina Vasilyevna surpassed the output norms on adding machines by 140 to 160 percent with an excellent quality of work. She completed her quota for the 5-year-plan in its entirety in April 1984.

The machinery park of the RIVTs was recently completely renovated. Now, data for the M 5100 VK is prepared on a YeS-9002 data preparation device [UPD]. Since 1986, she has been moved to the section for preparing data on this machine. She has trained eight operators, who know their occupation well and who have fulfilled their quotas and individual Socialist duties successfully. Three of them have earned the title "Outstanding Worker of Communist Labor."

When analyzing and generalizing the work of K. Chervonnaya, who is the leading operator at the VTs of the Statistical Administration of the Chernovitskaya oblast and winner of the All-Union Socialist Competition for the Title "Best Operator of the Computer System of the USSR TsSU" for 1985, it should be noted that she has completed almost 20 years in the operational stage of the collective of the computer center, to which she came in 1966 after finishing secondary school. During her work, she has assimilated card-punching, bookkeeping, invoicing, and adding machines and computers. Her thorough knowledge of primary documents and the entire production process of processing documentation is the base of her highly productive labor. In combination, these factors make it possible for her to use computer technology, and they help correctly select a computation method and use efficient methods.

She combines work on a computer with work on an invoicing machine. She supasses the output norm by 120 to 140 percent with excellent quality.

I. Chinyakova has worked at the Sevastopolsk GIVTs since 1973. She is an outstanding worker of Communist labor, winner of the All-Union Socialist Competition Among Workers of the Leading Occupations in the Sector in 1984 and 1985, and is a winner of the Socialist competition in honor of the 27th Session of the CPSU.

Working on a computer, she has assimilated all existing forms of computer keyboard technology, and using advanced methods unimpeachably, she surpasses output norms by 140 to 150 percent daily. She has reduced losses of working time to a minimum and has attained stable operation with a high quality of output production since first presentation.

Since December 1985, I. Chinyakova became the head of a compex microcomputer brigade that works without anybody lagging behind. Here, the combination of occupations and their interchangeability is broadly developed. The brigade leader has shared her rich experience with young brigade members and pupils. She has trained three operators just since 1985. The brigade members speak of their brigade leader with love.

In a short time, I. Chinyakova has assimilated mechanized processing of statistical reporting, routing sheets, and individual wage statements and has introduced a number of proposals to increase the effectiveness of using new computer hardware, the Iskra-555 and Neva-501. She is currently working on her August 1987 account.

N. Chernenko began her working life in 1979 at the Republicwide Collective-Use Computer Center of the Ukrainian SSR TsSU as an operator of Askota-170 bookkeeping machines. She quickly assimilated the operating capabilities and technology of operating this machine. She is constantly increasing her business qualifications. Having completed a course to prepare an operator-dispatcher on the YeS-9003 UPDML, she is working as an operator on this device.

Since 1981, all information is processed on the YeS-9003 according to previously developed formats. Before new work, she studies her instructions thoroughly. N. Chernenko assimilated the keyboard and operating capabilities of the machines well and is using this efficiently in her work. For example, if a format provides punching up to 80 columns and the record is short, then it is necessary to press the "VLØ" key as many times as is provided by the field in the given format in order to fill information to 80 columns. However, it is possible to use the "PRKh" key, the single pressing of which will fill out to 80 columns. When processing information of one type, the "double" key is used as the specified indicator.

A great practical experience and knowledge of the documents with which it is necessary to work and the ability to compile prototypes make it possible to work with formats that exclude erroneous information. After finishing the courses for operators of the Robotron-1720 EFBM, she combined work on this automat with work on the Iskra-122 computer.

Her thorough knowledge of primary documents, instructions, and prototypes and ability to give value to each minute of working time use all the capabilities of a machine, and use efficient procedures that make it possible for her to surpass output norms by 150 percent with an excellent quality of work.

An outstanding worker of Communist labor and teacher of youth, she has supported advanced initiatives and movements directed toward early fulfillment of 5-year-plan quotas. She completed the plans of the 11th Five-Year Plan before the 50th anniversary of the Stakhanov movement.

She does not keep her professional "secrets" to herself but shares the fine points of her professional mastery, knowledge, and accumulated experience with her comrades and implants her love for her occupation to youth. She took part

in the contest of the RVTsKP of the USSR TsSu for the title "Best in the Occupation," took first place among the operators of the YeS-9003 UPDML section, and was awarded the badge of the 5-Year Central Committee of the VLKSM of the Ukraine entitled "Young Guardian of the 11th Five-Year Plan."

L. Galushko has worked as an operator at the VTs of the Statistical Administration in Kiev since 1966. She has on her shoulders a rich professional experience that makes it possible for her to fulfill and surpass production quotas. She has fulfilled her personal five-year plan in 4 years and the planned quota for 1985 before August 30. She is an initiator of the initiative "For Work From First Presentation."

While working on an adding machine in a complex brigade, L. Galushko assimilated related sections on the T-5 MV, PD-45, and S-45 machines. She is constantly searching for efficient techniques to attain the maximum productivity with a minimum of labor expenditures. She has studied the operating capabilities of the card punch and tabulator, document-processing technology, and punching prototypes thoroughly and knows the primary documents and the arrangement of data items in them well. All of this facilitates an increase in the effectiveness and quality of the work she completes. She uses the "touch" method and checks for the correct initial position of her hand and placement of her fingers on the keyboard, rhymicality of stroke, and reduction of operating motions. When taxing departments, she uses a storage that enables her to obtain a check sum without additional operations.

G. Galushko gladly shares her experience with her comrades in the brigade, is a good teacher, and has trained three young operators.

In the computer system of the USSR TsSu there is someone to equal and someone from whom to take an example. These are the leaders and innovators of production, people of high professional mastery, who have shown in practice what it means to live and work in the rhythm of acceleration today. Such people work in each collective of the computer system of the USSR TsSu, and it is very important that these leaders of production have their followers.

12794
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BOOK: CONFLICT THEORY

Moscow NOVOYE V ZHIZNI, NAUKE, TEKHNIKE: SERIYA MATEMATIKA, KIBERNETIKA (KONFLIKTY I KOMPROMISSY) in Russian No 9, 1986 pp 1-5, 32

[Table of contents, annotation, and introduction from book by Nikolay Serafimovich Kukushkin, Olga Rostislavovna Menshikova, and Ivan Stanislavovich Menshikov, "Conflicts and Compromises," Znaniye, Moscow, 1986, 34,600 copies, 32 pages]

[Text] TABLE OF CONTENTS

ANNOTATION

Mathematical methods are playing an ever-increasing role in the practice of decision making. This refers to the study of conflict situations where it is possible for several factions that are striving toward a specified goal to initiate certain actions.

This pamphlet deals with the compromise theory, which is a special branch of the game theory and is based on classical concepts (strategy, victory function, equilibrium, threat, etc.). A mathematical description of conflict is presented, and the possibilities of its resolution through compromise are studied. The discussion is illustrated by examples of conflict situations.

This issue is intented for lecturers, students, and teachers at national universities.

INTRODUCTION

The word "conflict" generally arouses unpleasant associations. These include the thunder of weapons, a quarrel in a communal kitchen, and multihour examinations at local trade union committees. However, this word is used in a much broader sense in systems analysis. We will use the term conflict situation in all cases where it is possible for several participants who are striving toward specified goals to initiate certain actions and where the degree to which each participant attains his or her goal depends on the actions of all the participants. A conflict situation may lead to conflict in the ordinary sense of the word, but this is not necessary. For example, if two individuals want to go through the same door at the same time, they may bump foreheads or they may avoid this.

Of course, it is possible to study conflict situations from very different aspects. We will be concerned with the possibilities for a compromise resolution of the conflict and related problems or, more precisely, with a mathematical description of these possibilities and problems. The entire set of corresponding mathematical models and methods will be termed "compromise theory." This term should not be understood in its usual sense; we are using it exclusively for brevity.

We will imagine that, understanding their dependence on each other, the participants in a conflict situation will meet to discussion the situation as a whole and will make a joint decision to have each person act so that everything "turns out alright." Understandably, the most diverse ideas about how this joint decision should be arrived at and the organizational measures that could strengthen the agreement so that it doesn't just exist on paper will be expressed in the course of such a discussion. Compromise theory studies all such possible ideas and proposals by trying to give each a precise mathematical formula and thereby keep the participants from aruguments over trivial matters. He we must limit ourselves to the most abstract description of the initial conflict situation, although when analyzing specific situations it is of course necessary to take their distinctive features into account.

The conflict situation itself must be sufficiently "serious" so that a comprehensive discussion of the joint decision, and even one using mathematical methods, is justified. People meeting at the doors of a store can hardly expect help from compromise theory; they must use common sense and a basic sense of tact. (If such individual collisions are viewed as particular cases of the general problem, then here a special study, one recommendation of which could, for example, be to let the person exiting go first, might be justified.)

From now on, we will image that the participants in the conflict are rather large entities and that all negotiations are conducted by specially designated representatives. When such a representative is designated, the objectives and capabilities of the given participant must necessarily be stipulated in one way or another. On this basis, when developing a mathematical description of the conflict situation we will consider that each participant's possible courses of action form a previously specified set and that the objective

consists of attaining the specified index of the efficiency function with the greatest value (depending, generally speaking, on the actions of all the participants). In ordinary situations, the hypothesis that the participants' possibilities and objectives are completely specified is not very realistic.

Moreover, we will consider that each participant knows the objectives and possibilities of all his or her partners. Of course, this is a very serious hypothesis, but rejecting it would result in very significant difficulties of a technical as well as conceptual nature.

To outline the circle of tasks of compromise theory more clearly, let us say now that it does not attempt to predict the behavior of the participants in any real conflict and does not give any recommendations about a specific course of behavior to any participant in the conflict situation or even to all participants together. It only proposes some reasonable ideas, but not an unequivocal specified version of an agreement about joint actions. Within traditional mathematics, the best analogy to compromise theory is mathematical logic, which does not study the thinking of real mathematicians precisely and does not give unequivocal recommendations concerning how a dicussion should proceed either. Of course, this analogy may appear very superficial; however, it seems useful for the reader to keep in mind.

It is difficult to call compromise theory a branch of applied mathematics; however, it has a marked applied nature. Its very development has created a certain language that is suitable for describing and discussing all problems occurring during the attempts of several rival participants to reach an agreement about their actions. Of course, this langage cannot solve any problems in and of itself. With its help, however, it is easier to reach a reasonable compromise. If one of the participants in the conflict situation has a noticeably lesser command of this language, then he or she may be faced with an unpleasant dilemma, i.e., whether to agree to the version worked out by the other participants and thereby essentially risk an unfavorable agreement or whether to swing away from the other participants before the end of the proposals that are understood, essentially eliminating the possiblity of a compromise resolution of the conflict. Evidently it is precisely this idea that must stimulate interest in compromise theory in our time of the rapid propagation of mathematical methods.

By now, many readers have wanted to know how compromise theory differs from game theory, any problem of which immediately entails the mathematical modeling of conflict situations. Certainly, the briefest answer to that question is the following. When we speak of compromise theory, we are simply singling out those methods from the entire set of theoretical game concepts that are directed precisely toward analyzing the problems arising during the search for a compromise resolution of a conflict by its very participants. Of course, the selection of material is dictated by the need for this analysis rather than by a desire to stay within the bounds of game theory, although they aren't so clear anymore (for example, can Pareto optima be considered an intrinsic concept of game theory?). It is suggested that readers wishing a more comprehensive understanding of game theory consult the rather extensive literature that exists on the subject.

The necessity of a special analysis of the problems related to seeking a compromise have been emphasized time and again by Yu. B. Hermeier (1918-1975) whose strong influence has shaped the scientific interests of the authors. A significant portion of this book is related to the ideas of Yu. B. Hermeier and their further development.

One note on terminology should be made in conclusion. Generally speaking, we will simply use the term conflict situation to denote the mathematical model of a conflict situation, and we will use the word "game" in its more usual sense, i.e., for specially organized conflict situations with distinct behavioral rules. In games, the possibilities and objectives of all the participants are specified by the rules of the game; therefore, our hypothesis about their being completely specified and generally known is completely justified.

The authors thank Academician N.N. Moiseyev, on whose initiative this pamphlet was written, for his continued attention to this work and good advice.

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INTERFACE BETWEEN APPLICATION PROGRAMS AND SESSION LEVEL OF LOCAL AREA NETWORKS

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 3, May-Jun 86 (manuscript received 22 Jul 85 (10 Dec 84) pp 17-21

[Article by A. N. Domaratskiy and V. V. Nikiforov]

[Abstract] A simple solution is presented for construction of a standardized interface between application programs and the session level of a LAN. The interface defined between the user and session levels of the LAN allows file transfer sessions between network users. The minimum file interface allows transfer of sequential files between LAN users. Organization of a communications session is described. An expansion of the file interface is described, with which it is no longer necessary to format information for transfer as a sequential file on a user peripheral storage device. The principles of organization of interface between application programs and the session level of LAN are thus basically oriented toward file transfer between application programs running on different work stations in the network. The use of file access channels provides relative simplicity of design and effective functioning of the LAN session level.
References 4: Russian

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PRINCIPLES OF IMPLEMENTATION OF MULTIFUNCTIONAL INTEGRATED NETWORK SERVICE

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 3, May-Jun 86
(manuscript received 12 Nov 85) pp 45-54

[Article by E. V. Zinovev, A. A. Strekalev and N. A. Piziks]

[Abstract] A previous work analyzed the design of a multifunctional integrated network service utilizing a basic set of components. This work demonstrates the concept of network service design using the example of a file management subsystem and task execution by the multifunctional integrated server MISA. The integrated service is intended to provide unsophisticated users, application programmers and system programmers with appropriate access to the computer resources of the network. The major subservices provided are therefore the network data base management subservice, file storage and job management subservice, administrative management subservice and process and resource monitoring subservice. The capabilities of each subservice are described. The set of basic functions and suggested command structures are presented for each subservice. The kernel of the multifunctional integrated network service is implemented by descriptive processing of user commands utilizing a decision table. The service provides the users with a broad range of services, the most important of which is simultaneous access to data and computer resources, supporting the interaction of information and computer processes. MISA operates under OS YeS version MVT 6.1, SVS version 6.9, and SVM in mode MVT 6.1. The kernel occupies 300 K-bytes, while total main memory required is 1-1.3 M bytes. Figures 4, references 5: Russian

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METHOD OF MONITORING COMMUNICATIONS CHANNELS IN COMPUTER NETWORKS

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 3, May-Jun 86
(manuscript received 16 Oct 85 (13 Jun 85) pp 55-60

[Article by I. M. Bukin]

[Abstract] A study is made of the problem of monitoring communications channels, which are complex computer system components generally consisting of hardware, software and a physical medium through which information is transmitted. Specific communications channel monitoring methods are needed to perform monitoring with the minimum possible redundancy of hardware, software and physical transmission medium. The monitoring methods must also allow bidirectionality, switchability, implementation of communications protocols and discreteness. A method of solving the problem has been suggested. Its essence is that the moment when a signal is transmitted and when the acknowledgement is received are recorded at a certain point on the network, the interval between these moments is compared to the assigned acknowledgement time, and an error signal is generated if the time required for acknowledgement becomes too long. The monitoring point is also the point at which communications channels are switched upon receipt of an error signal. Major advantages of the method include absence of additional time or software costs of monitoring, achievement of monitoring with minimal redundancy of hardware, none of software or transmission medium, possibility of monitoring communications channels transmitting either parallel or series code, possibility of monitoring channels with or without confirmation, possibility of monitoring several channels with one hardware device, great diagnostic capabilities, reduction in the number of switches required per channel, and an increase in effectiveness of monitoring with an increase in the length of an information word.
Figures 2, references 5: Russian

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DIAGNOSTIC SUPPORT OF LOCAL AREA NETWORKS

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 3, May-Jun 86 (manuscript received 16 Oct 84) pp 68-74

[Article by V. A. Kizub]

[Abstract] A study is made of problems related to the design of diagnostic support for local area computer networks (LANs) used for automation of production processes. Diagnostic support refers to a hardware-software complex permitting formalization of the description of the diagnostic apparatus, determination of the list of parameters monitored and diagnosed, development of diagnosis algorithms, automation of the process of synthesis and conduct of tests, modeling of objects of diagnosis, as well as the actual process of diagnosis and evaluation of the effectiveness of diagnosis procedures and equipment. The planning of diagnostic support is described as a goal-oriented iterative process of development of documentation. The planning of the diagnostic support of a LAN is a complex and as yet insufficiently studied problem, the solution of which requires large teams of qualified specialists. Results have been achieved, however, in related areas, such as the diagnosis of computer systems, communications systems and process control systems.
Figures 2, references 8: 4 Russian, 4 Western

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TRANSPORT RADIO NETWORK HARDWARE

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 3, May-Jun 86 (manuscript received 13 Jun 85) (20 Nov 84) pp 75-82

[Article by A. P. Voyter and R. G. Ofengenden]

[Abstract] A transport radio network is a single-channel network in which a network controller device manages the interface between a user and the data transmission radio channel. The controller may have all functions embodied in hardware, may utilize a specialized LSI chip set including a microprocessor and program in ROM, or may utilize a universal microcomputer and special program. This article analyses a network controller implemented in software on an "Elektronika-60" microcomputer with a special radio channel access module. The device is intended to connect YeS and SM series computers to a computer network by means of packet-based communications. A carrier-sense multiple access protocol is implemented. Series-produced radio relay transceiver equipment is used.
Figures 4, references 6: Russian

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UDC 681.326.7

RELIABILITY OF ONES-COUNTING AND SIGNATURE ANALYSIS IN MONITORING AND DIAGNOSIS OF DISCRETE NETWORK STRUCTURES

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 3, May-Jun 86 (manuscript received 1 Oct 85) (16 May 85) pp 82-86

[Article by V. N. Yarmogik and Ye. I. Katsnelvon]

[Abstract] Compact testing of discrete network structures requires selection of a method of compact testing for each specific application. The dominant measure of effectiveness of a method is its reliability, determined by the probability of failure to detect an error in a sequence taken from the output of the unit being tested. Signature analysis is widely used in practice as a compact testing method. A previous work by one of the authors suggested that the distribution of probabilities of failure to detect errors as a function of error multiplicity be used to select a compact testing method. This method of counting ones is determined to be preferable to signature analysis if the number of ones in the analyzed output sequence approaches zero or the length of the sequence. This requirement can be achieved by selecting test sets to be fed to the discrete structures being studied. References 7: 6 Russian, 1 Western

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MODEL OF NETWORK INTERACTION ORIENTED TOWARD IMPLEMENTATION OF A PROTOCOL

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 4, Jul-Aug 86 (manuscript received 19 Aug 85 (12 Feb 85) pp 3-9

[Article by M. L. Mirimov]

[Abstract] A study is made of a model reflecting the specific peculiarities of functioning of network protocols, developed primarily as a means for designing and debugging of a multitasking programming system implementing the protocol. The primary advantage of the model is its good "projectability" onto modern methods of organizing parallel processes in computers with traditional architecture. In the asynchronous-procedure model suggested, the set of hardware and software network objects implementing the protocol is represented as a two-part oriented graph, the lines of which are information transmission lines. A graph of the asynchronous procedure model of a specific protocol is formulated as a portion of the graph of the summary model here developed. Model behavior is analyzed by analyzing trajectories on the graph as information is exchanged among objects and studying the chains of transitions thus formed. A correctly and fully defined asynchronous procedure model of a protocol is an unambiguous, strict specification of network software. Figures 4, references 4: 3 Russian, 1 Western

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UDC 681.3.06.2

OPTIMIZATION OF PLACEMENT OF REMOTE INFORMATION CONCENTRATORS IN A CENTRALIZED DATA TRANSMISSION NETWORK CONSIDERING COMMUNICATIONS CHANNEL RELIABILITY

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 4, Jul-Aug 86 (manuscript received 6 Mar 85) pp 10-19

[Article by G. F. Yanbykh]

[Abstract] The statement and algorithm for solution of the problem of selecting the number and points of placement of remote information concentrators plus the terminal systems of main and reserve communications channels connected to them are described. The required throughput capacity of the communications channel between a remote information concentrator and computer system is determined considering the total intensity of message streams from terminal systems over both main and reserve channels. Limitations include the maximum number of terminal systems connected to a concentrator, the finite set of possible throughput capacities of communications channels, and the mean message delay time in the network. It is assumed that communications channel failures are random and independent of the status of other channels, the probabilities of failure of channels are independent of whether they are in use or not, the stream of messages in each channel is a Poisson stream, the flow of failures is steady and follows the Poisson distribution, the time of repair of a channel is independent of the status of other channels, message servicing time in a channel is distributed exponentially, streams in the channels are independent of each other, the message queue length at the input of each channel is unlimited, messages are lost when no data transmission channels are available between the concentrator and the computer system, and failures are instantly detected and messages instantly switched to reserve channels.
Figures 2, references 18: 17 Russian, 1 Western

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UDC 621.391

PRINCIPLES OF DESIGN OF LOCAL COMPUTER NETWORK FOR MESSAGE SWITCHING CENTER

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 4, Jul-Aug 86 (manuscript received 25 Sep 84) pp 53-57

[Articley by Yu. A. Mamatov, N. M. Badin, S. F. Bulychev, S. G. Volchenkov, A. A. Korotkin and A. Yu. Levin]

[Abstract] The effectiveness and viability of a local area network message switching center are assured by selecting effective network structures and proper organization of software. This article discusses these problems and suggests a method for quantitative evaluation of network effectiveness as a function of hardware characteristics. The message switching center is assumed to consist of several identical bus-oriented microcomputers. The software used at the center includes programs for actual switching of messages, syntactical message analysis, correction of message distortions, routing, and control of the microcomputers used at the center. The message processing programs are not attached rigidly to specific computers, but rather can be run on any available processor of any available microcomputer. the director program runs on a single microcomputer, but can be transferred to the memory of another computer and run on one of its processors if necessary. References 2: Russian

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CSO: 1863/161

UDC 681.324

ADAPTIVE TIME SHARING COMPUTER CENTER SCHEDULER FOR COMPUTER NETWORK INFORMATION-CONTROL SERVICE

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 4, Jul-Aug 86 (manuscript received 30 Sep 85) pp 65-70

[Article by S. V. Nazarov, A. A. Primakov and A. I. Kvasov]

[Abstract] The scheduler of a collective-use computer center (vTskP) controls several computers which make up the multimachine computer system at the computer center, distributing processes among the machines. The most difficult task is planning parallel computations performed simultaneously on several such machines. There are two possible approaches to the solution of this problem: Static and dynamic planning. This work suggests an approach to the design of a collective-use computer network scheduler which adapts to changes in the parameters of the input process stream. The method can be used to construct local computer network schedulers and schedulers for multiprocessor computer systems with arbitrary numbers of computers.
Figures 2, references 8: Russian

6508
CSO: 1863/161

UDC 658.012.681.3

OPTIMIZATION OF THE STRUCTURE OF AN INFORMATION-COMPUTER NETWORK BY THE METHOD OF BRANCHES AND BOUNDS

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 5, Sep-Oct 86 (manuscript received 16 Jan 86) pp 3-13

[Article by G. F. Yanbikh]

[Abstract] A new approach is suggested to determining the number, speed and location of computer systems which will exchange information through communications channels in a data transmission network. It is assumed that each user is connected to one computer system. The major features of the new approach are: 1) In addition to requests and responses, the information message from one user to another is also analyzed; 2) Each computer system is represented as a set consisting of operating and communications systems; 3) The speeds of the operating and communications systems must take on discrete values; 4) In constructing permissible solutions to the problem, the main computer network is not assumed to be fully connected; 5) Algorithms based on the method of branches and bounds with undirectional branching are used to solve the problem. The optimization algorithm produces an approximate solution to the problem of synthesis of the physical structure of the information-computer network satisfying the principles of open network architecture. Figures 2, references 10: Russian

6508
CSO: 1863/162

UDC 691.324

STUDY OF THROUGHPUT CAPACITY OF USER SYSTEMS IN A LOCAL COMPUTER NETWORK

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 5, Sep-Oct 86 (manuscript received 20 Feb 86) (7 Mar 85) pp 39-42

[Article by B. Ya. Ettinger and Z. A. Rozenberg]

[Abstract] One of the most important tasks in LAN planning is that of matching the throughput capacity of user systems to the characteristics of the network as a whole and particularly to the characteristics of the transmission medium used in the network. There are three major aspects to this problem: Design, i.e., selection of necessary speed and memory characteristics; analysis, i.e., estimation of the correspondence of the user systems to the operating conditions in the network; and improvement or tuning, i.e., determination of variable parameters such as input buffer size which can provide the best matching of user systems to network characteristics. A mathematical model and calculation equations are suggested for the solution of this problem.
Figures 6, references 3: Russian

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COMBINED MODELS AS A MEANS OF INTEGRATED INVESTIGATION AND SOFTWARE IMPLEMENTATION OF COMPUTER NETWORK PROTOCOLS

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 6, Nov-Dec 86 (manuscript received 21 Mar 86) pp 5-12

[Article by G. Y. Pranyavichyus]

[Abstract] The complexity of functioning algorithms means that only simulation models can be used to model computer network protocols. This article presents a combined approach to solution of the problem of designing computer network protocols. The status of work in this area is outlined. It is noted that this work is now creating the prerequisites for development of methods and software facilities for automated protocol design. The major advantage of this approach in comparison to others is that it allows, with a slight change in the base specifications of a protocol, the creation of a model for analysis of both correctness and effectiveness of protocols, and also supports software implementation of protocols. The methods and systems for modeling and verification presented in this work create a theoretical basis for the development of systems for automated design of computer network protocols. This approach has been used in the PRANAS protocol analysis system, including the AGreGAT-8Y specification language. It is implemented on an SM-4 running OS RV.
References 11: 9 Russian, 2 Western

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CSO: 1863/163

UDC 681.324

METHOD OF ANALYZING CORRECTNESS OF PROTOCOL SPECIFICATION

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 6, Nov-Dec 86 (manuscript received 10 Dec 85) pp 39-43

[Article by I. K. Rakova and N. N. Smirnova]

[Abstract] A method is presented for analysis of the specifications of a protocol, implemented as a group of programs and based on the Milner algebraic theory of synchronization. A protocol model is a system of interacting components fixed by finite automata. The behavior of each component is described from the standpoint of an external observer. The interaction of the components of the system consists of the exchange of messages. Each component has a finite set of ports for message interchange with other components or the environemmt. Each component is described by its behavior. At each moment in time, the components have a certain set of capabilities for transmission and reception of signals. Analysis of the correctness of a protocol amounts to analysis of the behavior of the entire system of interacting components. Algebraic operations in the class of static operations are used to produce a tree describing the behavior of the entire system. Each pair of independent interactions in the system leads to a single global state, so that further construction of branches of the behavior tree can be performed just once, for one sequence of independent interactions. This solution of the problem of minimizing the behavior tree decreases the work of the algorithm by up to 90%. This approach has been realized in the PASCAL-based AKO RP protocol correctness verification package in YeS and SM versions.
Figures 2, references 4: 2 Russian, 2 Western

6508
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UDC 519.95

MODELING OF PETRI NETWORKS OF LOGIC CONTROL ALGORITHMS

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 6, Nov-Dec 86 (manuscript received 10 Dec 85) pp 44-51

[Article by A. D. Zakrevskiy]

[Abstract] Analysis of the correctness of network protocol algorithms, considered parallel logic control algorithms, can be reduced to checking the correctness (viability and safety) of the Petri network representing the skeleton of the algorithm, formed by the set of transitions among linear portions of the algorithm. However, the information interaction of these portions remains unclear. The consideration of this interaction is the subject of this article. A method is presented for constructing an expanded Petri network to consider the information interaction of portions of the software.
Figures 2, references 6: Russian

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CSO: 1863/163

UDC 681.324

FORMAL DESCRIPTION OF NETWORK SYSTEMS IN PREDICATE LOGIC LANGUAGE

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 6, Nov-Dec 86
(manuscript received 28 Mar 86 (24 Dec 85) pp 52-58

[Article by I. M. Gurevich]

[Abstract] Networks of computers approach natural objects in their complexity. Formal descriptions of networks require the use of formal tools which can adequately, unambiguously and compactly describe the network without contradictions. Known methods of description utilize the methods of mathematical logic, but the capabilities of mathematical logic, particularly predicate logic languages, have not been fully used. This article demonstrates that the language of predicate logic is an effective means of formal description of network systems. Characteristics of a network are presented and it is suggested that the predicate logic language SET' ["network"] be used for a formal description. Such a description is developed in the SET' language. Formal description of a network allows the powerful apparatus of predicate theory to be used to analyse the consistency of the system of network algorithms and protocols, their completeness and unambiguity, as well as their complexity.
References 13: Russian

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UDC 631.395.341

MEANS FOR DESCRIPTION AND MODELING OF COMPUTER NETWORK PROTOCOLS IN SDL

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 6, Nov-Dec 86 (manuscript received 17 Jul 86 (10 Mar 86) pp 69-75

[Article by G. L. Ionin and V. V. Supe]

[Abstract] The language SDL has been suggested by the CCITT as a means for design and description of the functioning of electronic telephone exchanges. The computer center of Latvian State University has studied the possibility of using this language as a basis for description and modeling of discrete systems in an expanded area of application including the broad class of queuing systems such as computer networks. A language for simulation of discrete systems called SDL/PL has been developed on the basis of SDL and PL/1, to run on the YeS computers under OS VMS [as written]. The language SDL/PL generates a model in the form of a set of descriptions of processes or components and a description of the model which controls the operation of the model. Process descriptions are developed for each type of process in the model. The description of a universal timer is presented to illustrate the design and principles of construction of process descriptions in the language.
Figures 8, references 9: 8 Russian, 1 Western

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APPROACH TO RELIABLE HARDWARE IMPLEMENTATION OF PHYSICAL LEVEL PROTOCOLS FOR NETWORK ARCHITECTURE

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian, No 6, Nov-Dec 86 (manuscript received 11 Mar 86) pp 76-81

[Article by V. I. Varshavskiy, V. B. Marakhovskiy, L. Ya. Rozenblyum, Yu. S. Tatariinov and A. V. Yakovlev]

[Abstract] One peculiarity of the physical level of network architecture is the need to increase the reliability of information exchange in case of loss or distortion of messages. The physical level must assure fault tolerance of the hardware. This work expands the concept of self synchronization suggested in a previous work as applicable to the problem of designing a fault-tolerant interface based on the common bus principle. Problems related to the implementation of this concept are studied. The concept is quite suitable for an evolutionary approach to the introduction of fault-tolerant self-synchronizing VLSI devices in the physical level of network architecture. Problems discussed include selection of a coding method, selection of an information transmission method, and organizing collective acknowledgement and self repair, meaning diagnosis of defects, localization of defects and repair by reconfiguration, resulting in replacement of a defective unit with a functioning unit.
Figures 5, references 11: 8 Russian, 3 Western

6508
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COMPUTER IN THE SCHOOL

Riga NAUKA I TEKHNIKA in Russian No 7, Jul 86 pp 14-16

[Article by Modris Eglays, candidate of physico-mathematical sciences, head of the scholastic informatics problems laboratory of the Computer Center of Leningrad State University im. P. Stuchka]

[Text] The computer in education plays a dual role. Firstly, the computer is the embodiment of a new field of knowledge- informatics. The fully adequate assimilation of this field is not possible unless the pupils and teachers regularly practice on the computer. Thus the complete program version of the "Bases of Informatics and Computer Science" course stipulates 32 hours of individual work at the computer display for each pupil. In this time they must acquire computer interaction skills and a clear understanding of software operation principles and the capabilities of the computer to solve applied problems. In addition, the pupil must in some sense become familiar with the "character" of the computer as a partner in the interaction. The computer and the interaction with it by this approach are, in general, the object of research and assimilation.

Secondly, the computer can be successfully used as a teaching aid. It is not without reason that a new direction, automated teaching, has appeared in pedagogy. Thanks to their graphics, sound and color capabilities, modern computers can be successfully used to study practically all academic subjects. It is precisely this application of computers in the school that entails a large number of problems and causes arguments and differences of opinion among people involved in various aspects of this question: First of all the teachers, and computer specialists. We shall be examining the most important of these problems.

The extensive introduction of the computer in academic education requires outlays and physical input, the enlistment of scarce resources and the participation of highly skilled specialists. All of this must be justified by a significant increase in teaching quality and effectiveness. This can certainly be achieved when highly specific skills, even very complex ones, are being mastered, especially in those fields in which the nature of the knowledge acquired in this manner does not require the impression of a teacher's personality. Studying the rules of grammar, mastering musical notation and acquiring a good ear for music, mental arithmetic skills, the

skills of operating a typewriter keyboard (which is very similar to that of the computer), the properties of chemical elements or compounds and methods of analyzing them, Rules for motor vehicle operation, factual data from history, geography, astronomy- all of this and many others can be mastered interactively with the computer as highly interesting and even fascinating lessons under the guidance of the teacher.

Actually this guidance is nominal: Such lessons utilize the work of another teacher (or more precisely, methodologist) who wrote the instructional scenario upon which the program is based. Here the computer interacts individually with each pupil, dispensing new material, reinforcing it, and asking questions and monitoring assimilation.

According to the experience gathered in our scholastic informatics problem laboratory of the Computer Center of Leningrad State University im. P. Stuchka, it is simple to conduct such lessons when good teaching programs exist, and the teacher is not loaded down with routine work, where, however, his role as a methodologist is transferred to the specialist whose writes the scenarios for particular teaching programs (in my opinion, arguments about whether this is good or bad are irrelevant here--this is a subject for independent research).

Another area of application of the computer in the educational process is the computer simulation of processes that occur in nature, in society or in industrial apparatus. The capability of creating an active interaction between the pupil and the model of the studied phenomenon has come about, in which the pupil during an experiment can see the principles that control the object and study the consequences of particular actions. He can convince himself what would happen if the entire Earth were covered with factories or if opportune expenditures for environmental protection measures are not allocated. The computer can be used to land a space craft on the Moon, fly an aircraft, control an entire plant or a small government, make archeological excavations of ancient settlements, study the operation of a transistor or oscilloscope, learn how the chain reaction in a nuclear reactor is controlled, how substances are exchanged within the human body, how the human heart is organized and how it operates under various physical loads.

The general principle of this method consists in teaching the pupil through the active control of models of actual processes that are realized with the computer. Up to now this form of teaching has been almost nonexistent in the schools; frequently it can not be realized by standard methods both as the result of economic considerations (it would be rather difficult for the school to acquire, for example, an operational nuclear reactor), and for safety reasons.

Teaching with the aid of models is today extensively used in science, engineering and economics. It holds great promise for the solution of social problems in which opportunities for conducting actual experiments are also limited both by ethical and economic considerations. The very process of constructing the model serves as a powerful stimulus to expose the essence of the studied processes and search out governing principles. The role of the teacher is still very significant even when ready teaching programs of this

type are used, while the influence of his personality, pedagogic qualities and skills possess decisive significance both for the teaching quality and the educational process. Analyzing the model's construction together with the pupil and attempting to improve it, the teacher can achieve an extremely thorough understanding of the essence of the studied processes.

The computer can also serve as an excellent tool for developing the creative capabilities of pupils. Computer graphics, including color graphics, and programmable sound synthesizers are aids for professional-level work in music, fine arts, animated cartoon creation, etc. Broad opportunities are opening up for the scholastic computer in administrative management in order to solve such problems as monitoring attendance and progress, lesson scheduling, business letter preparation, and materiel accounting. The computer will become an aid in extracurricular activities and in the operation of the school's broadcast relay exchange and radio station: In the near future pupils of different schools will be able to exchange programs and other information with their computer over telephone lines or through amateur radio stations, perhaps even by satellite communications.

Certainly the information created at the scholastic computers or intended especially for them will also circulate in the computer networks now being created in the republic and throughout the nation.

Scholastic computers will play a very great role in teaching physically handicapped children. The application of the computer in this area can even now expose these children to completely new opportunities for creative activity and new ways of apprehending the world in all of its complexity, and help them to become equal members of society despite their handicap. The computer holds great promise for the occupational orientation of students, including diverse testing. Computerization can significantly improve both the effectiveness and quality of skills training.

However, one should not think that the computer is omnipotent and can nullify the importance of the pedagog. In each case the computer is only the teacher's assistant which undertakes only rudimentary teaching functions, freeing the teacher to solve that part of the educational process that requires human participation. Many of the most important subjects that are particularly concerned with the mastery of abstract concepts and complex forms of thinking and with the development of the pupils' personality, ethical values and world view are left completely to the teacher, and attempts to "computerize" a substantial part of this aspect of the academic process would only be harmful.

The introduction of the computer into scholastic activities is a long and intrinsically on-going process; today we are taking only the first steps in this direction. It is important, however, that we have a clear perspective at this stage, and that those goals and opportunities provided by the computer in the school are not lost behind present difficulties and problems. It must be remembered that we are making the future workers and scientists of the 21st century out of the pupils of today, for whom interaction with the computer will be as natural as today a ball-point pen and paper are for us.

Informatics laboratories are the basis for introducing the computer into the schools. Such a laboratory must be equipped with an instructional computer facility which can solve every problem that arises when operating a computer. The hardware requirements for this facility have already been developed, and the software is now being developed. The facility is comprised of one instructor and 8-15 pupil computers connected with the instructor computer through a communications channel. Each pupil work station is equipped with keyboard and display screen, which, as a rule, is comprised of a particular version of an ordinary television screen. The pupils can work both with existing teaching programs or write their own programs in a particular programming language.

Floppy disks (which are like flexible phonograph records, but are coated with a ferromagnetic layer and enclosed in a protective envelope) or ordinary domestic magnetic tape recorder cassettes are used to store the programs. During a lesson programs are loaded from the medium into the instructor computer and are then transmitted to the pupil computers over the communications channel. The displays provide the ability to work both with text and images. The pupil computers must handle text in Russian and the national languages. Small printers can print the text of programs and other information.

The specialists direct particular attention to aspects of the children's health and safety. The power supply voltage delivered to the pupil work station must not exceed 42 volts. The picture tubes of the displays are implosion-proof. Radiation hazard has been completely eliminated, as in the case of domestic television sets. However, even with a good quality display screen, prolonged work at the display tires the pupils' eyes, thus they should not be allowed to work more than 2-4 hours per week in dependence on their age. As the hardware evolves and higher quality display screens are developed, the eye-fatigue factor will be reduced.

Unfortunately, difficulties associated with the series production of personal computers are holding back the extensive computerization of schools. It was only fairly recently that the production of the first domestically produced home computer, the "Elektronika BK-0010", was begun. Connected to an ordinary television set and to a cassette tape recorder, it can make calculations, play games, teach programming fundamentals and control domestic appliances.

However, a number of serious shortcomings prevents the "Elektronika BK-0010" from being used in the school: Ineffective keyboard design and inability to function as part of a local-area network. The absence of the Basic programming language from the software is another problem. The Fokal programming language provided with the computer is slow, too inflexible and does not have adequate error checking facilities. This means that the program runs until the first unforeseen or incorrect user answer. For instance, if the pupil pushes the "O" key instead of the 0 digit key, the machine returns him to the start of the program and the entire lesson begins again.

Today many scientific collectives, and, in particular, our laboratory, are working to eliminate these flaws, after which the "Elektronika BK-0010" may become a good scholastic computer. The production of these computers is

planned at several of the largest enterprises of our republic. They were primarily designed for the needs of schools and technical schools. Professional computers, ranging from the small "DVK-1" machine to large YeS mainframes are also entering the schools thanks to patrons.

It is very important to furnish informatics laboratories with teaching programs, but this is an extremely laborious process that demands the participation of highly skilled teaching methodology and programming specialists. Specialists estimate that the development engineers require about 200-300 hours to write a program that supports an hour's worth of interaction with the pupil. A large number of such teaching programs have been now been accumulated throughout the world. However, as a rule, these programs in their present form are inapplicable in our schools due to differences in the choice of studied material, different traditions, programs and experience in teaching academic subjects, language differences and due to computer incompatibilities. Thus the creation of software for the informatics laboratories now being created has become an urgent problem on a national scale, including in our own republic. Our laboratory is one of the methodological centers that is managing work in this field. It requires the extensive participation of teachers of diverse academic subjects, and the thorough study of the experience gained both in our own nation and abroad.

The era of school computerization has begun, and the future lies ahead of it. The best guarantee of success in this work is the enormous interest and enthusiasm of the pupils in working with the computer.

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